

AEROSPACE MEDICINE AND BIOLOGY

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BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH
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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES



National Aeronautics and Space Administration
Office of Management
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Washington, DC 1991

INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 255 reports, articles and other documents originally announced in June 1991 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of *Aerospace Medicine and Biology* was published in July 1964.

Accession numbers cited in this issue are:

STAR (N-10000 Series)	N91-19024 — N91-21058
IAA (A-10000 Series)	A91-28401 — A91-32448

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the publication consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations include the original accession numbers from the respective announcement journals.

Seven indexes—subject, personal author, corporate source, foreign technology, contract, report number, and accession number—are included.

A cumulative index for 1991 will be published in early 1992.

Information on availability of documents listed, addresses of organizations, and NTIS price schedules are located at the back of this issue.

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TYPICAL REPORT CITATION AND ABSTRACT

NASA SPONSORED
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ACCESSION NUMBER → **N91-10591*** # Good Samaritan Hospital and Medical Center, ← **CORPORATE SOURCE**
Portland, OR. Neurological Sciences Inst.

TITLE → **ROLE OF ORIENTATION REFERENCE SELECTION IN**

AUTHORS AND → **MOTION SICKNESS Semiannual Status Report**

PUBLICATION DATE → ROBERT J. PETERKA and F. OWEN BLACK Sep. 1990 37 p

CONTRACT NUMBER → (Contract NAG9-117)

REPORT NUMBERS → (NASA-CR-186612; NAS 1.26:186612) Avail: NTIS HC/MF A03 ← **AVAILABILITY SOURCE**

COSATI CODE → CSCL 06E ← **PRICE CODE**

Three areas related to human orientation control are investigated:
(1) reflexes associated with the control of eye movements and posture;
(2) the perception of body rotation and position with respect to gravity;
and (3) the strategies used to resolve sensory conflict situations which
arise when different sensory systems provide orientation cues which
are not consistent with one another or with previous experience. Of
particular interest is the possibility that a subject may be able to
ignore an inaccurate sensory modality in favor of one or more other
sensory modalities which do provide accurate orientation reference
information. This process is referred as sensory selection. This
proposal will attempt to quantify subject's sensory selection abilities
and determine if this ability confers some immunity to the development
of motion sickness symptoms. Author

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

NASA SPONSORED

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ACCESSION NUMBER → **A91-12594*** National Aeronautics and Space Administration. ← **CORPORATE SOURCE**
Ames Research Center, Moffett Field, CA.

TITLE → **CREW SUPPORT FOR AN INITIAL MARS EXPEDITION**

AUTHORS → YVONNE A. CLEARWATER (NASA, Ames Research Center, ← **AUTHORS' AFFILIATION**
Moffett Field, CA) and ALBERT A. HARRISON (California,
University, Davis) British Interplanetary Society, Journal (ISSN
0007-084X), vol. 43, Nov. 1990, p. 513-518. refs ← **JOURNAL TITLE**

Copyright ← **PUBLICATION DATE**

Mars crews will undergo prolonged periods of isolation and
confinement, travel unprecedented distances from earth and be
subjected to formidable combinations of hardships and dangers.
Some of the biomedical, psychological and social challenges of the
first manned Mars expedition are reviewed and means of aligning
humans, technology and space habitats in the interests of mission
success are identified. Author

AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 351)

JULY 1991

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LIFE SCIENCES (GENERAL)

A91-28641

A STATISTICAL THEORY OF AMINO ACID MUTATION

LIAOFU LUO and YUMING ZHOU (Inner Mongolia University, Huhehote, People's Republic of China) *Origins of Life and Evolution of the Biosphere* (ISSN 0169-6149), vol. 20, no. 5, 1990, p. 419-424. NNSFC-supported research. refs

Copyright

A statistical theory is proposed based on two assumptions: (1) that the observed mutation frequency of an amino acid depends on the mutation coefficient which describes the rate of the nucleotide substitution stochastically and (2) that the similarity of amino acids represents the fitness of a mutant under the selective pressure. Using this theory, 380 mutation frequencies were calculated, of which only 10 disagreed obviously with observations data. I.S.

A91-28642* Case Western Reserve Univ., Cleveland, OH. HYPERACTIVE VESTIBULO-OCULAR REFLEX IN CEREBELLAR DEGENERATION - PATHOGENESIS AND TREATMENT

STEPHEN E. THURSTON, R. JOHN LEIGH, LARRY A. ABEL, and LOUIS F. DELL'OSSO (USVA, Medical Center, Cleveland; Cleveland, University Hospitals; Case Western Reserve University, OH) *Neurology* (ISSN 0028-3878), vol. 37, Jan. 1987, p. 53-57. refs

(Contract NAS9-17439)

Copyright

A91-28875

VENTILATORY RESPONSES TO HYPOXIA AND HYPERCAPNIA IN AWAKE RATS PRETREATED WITH CAPSAICIN

G. T. DE SANCTIS, F. H. Y. GREEN, and J. E. REMMERS (Calgary, University, Canada) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 70, March 1991, p. 1168-1174. Research supported by Medical Research Council of Canada and Alberta Lung Association. refs

Copyright

The contribution of capsaicin-sensitive neuropeptide-containing C-fibers on the chemical control of breathing was investigated in unrestrained unanesthetized adult rats injected neonatally with capsaicin (50 mg/kg) or the vehicle. Ventilatory responses to hypoxia and hypercapnia were measured in the two groups of animals using indirect plethysmography, when rats were breathing air, 12 percent O₂ in N₂, 8 percent O₂ in N₂, 5 percent CO₂ in O₂, or 8 percent CO₂ in O₂. It was found that neonatal injections with capsaicin resulted in marked changes in both the magnitude and composition of the hypoxic but not of hypercapnic ventilatory response, indicating that the neuropeptide-containing C-fibers are essential for the tachypnic component of the ventilatory response to hypoxia. I.S.

A91-29448

EFFECTS OF HYPERGRAVITY ON ADHERENT HUMAN CELLS

YOLANDE GAUBIN (Toulouse III, Universite, France), F. CROUTE, B. PIANEZZI, M. C. PREVOST, and J. P. SOLEILHAVOUP *Microgravity Science and Technology* (ISSN 0938-0108), vol. 3, Feb. 1991, p. 246-250. refs

(Contract CNES-87-1245)

Copyright

Experiments on simulated hypergravity (2 to 15 g) were conducted using a centrifuge (radius: 80 cm; speed motor: 180 rpm). The effects of chronic hypergravity (7 to 10 days) on cultures of three human cell lines were examined; lung or dermic fibroblasts and lung adenocarcinoma A 549 cells. The results showed a significant decrease in cell proliferation connected to a significant decrease in culture DNA content under hypergravity, but only for lung fibroblasts. The protein content was never disturbed. Dermic fibroblast elastase activity was enhanced under 15 g. Total phospholipid content as well as relative amounts of phospholipid components, analyzed by thin layer chromatography, were unchanged in A 549 cells. Author

A91-29801

THE OVERALL MECHANISM OF ADAPTATION OF THE ORGANISM UNDER THE INFLUENCE OF POLYPHENOLIC ADAPTOGENS [OBSSHCHII MEKHAZIM PRISPOBLENIIA ORGANIZMA POD VLIANIEM POLIFENOL'NYKH ADAPTOGENOV]

A. V. LUPANDIN (Khabarovskii Gosudarstvennyi Institut Fizicheskoi Kul'tury, Khabarovsk, USSR) *Uspekhi Fiziologicheskikh Nauk* (ISSN 0301-1798), vol. 22, Jan.-Mar. 1991, p. 20-39. In Russian. refs

Copyright

This paper discusses the role of polyphenolic adaptogens of plant origin (such as glycosides, lignanes, and flavonoids) in the mechanism of human adaptation to extreme environmental conditions. The results of experimental investigations indicate that there are three basic components in the mechanism of polyphenolic-induced adaptation: (1) a selective modulation and limitation of catecholamine synapses of the sympathoadrenal system, (2) the inhibition of peroxidation of lipids, and (3) due to the first two effects, the stabilization of the hypophyseoadrenal system, leading to prolonged functioning during stress. I.S.

A91-29802

BIORHYTHMS AND AGE [BIORITMY I VOZRAST]

G. D. GUBIN (Tiumenskii Gosudarstvennyi Meditsinskii Institut, Tyumen, USSR) and D. WEINERT (Halle-Wittenberg, Universitaet, Halle, Federal Republic of Germany) *Uspekhi Fiziologicheskikh Nauk* (ISSN 0301-1798), vol. 22, Jan.-Mar. 1991, p. 77-96. In Russian. refs

Copyright

Experimental data are presented on the circadian system development. It is shown that the temporal organization of circadian rhythms in mammals changes with age, reaching an optimum in adulthood, and that aging corresponds to the loss of this optimal rhythm. The rate of the formation of a stable optimal biorhythm differs in different species. The role of exogenic factors in maintaining the optimal biorhythm during late stages of the organism's ontogenesis is discussed. I.S.

51 LIFE SCIENCES (GENERAL)

A91-29803

ENERGY METABOLISM DURING HIBERNATION IN SPECIES OF DIFFERENT PHyla [ENERGETICHESKII METABOLIZM PRI GIBERNATSII U PREDSTAVITELEI RAZNYKH FILOGENETICHESKIKH GRUPP]

E. Z. EMIRBEKOV and S. P. L'VOVA (Dagestanskii Gosudarstvennyi Universitet, Makhachkala, USSR) Uspekhi Fiziologicheskikh Nauk (ISSN 0301-1798), vol. 22, Jan.-Mar. 1991, p. 97-111. In Russian. refs
Copyright

Results are presented on investigations of the energy metabolism in tissues of amphibians, reptiles, and mammals in the course of hibernation and during periods immediately preceding and following the hibernation period. Results obtained on changes in different tissues of such energy-metabolism indices as ATP, creatine phosphate, inorganic phosphate, glycogen, and ketone bodies pointed to a similarity in the energy metabolism in tissues of mammals and the poikilothermal animals, during both the hibernation period and the preparatory period. On the other hand, most of the differences found among the animals of different phyla were found to occur upon awakening from hibernation. I.S.

A91-30666* Alabama Univ., Huntsville.

UNIQUE CELL CULTURE SYSTEMS FOR GROUND BASED RESEARCH

MARIAN L. LEWIS (Alabama, University, Huntsville) IN: TABES 90 - Annual Technical and Business Exhibition and Symposium, 6th, Huntsville, AL, May 15, 16, 1990, Submitted Papers. Huntsville, AL, Huntsville Association of Technical Societies, 1990, p. 184-189. refs
(Contract NAS9-17200)
(TABES PAPER 90-2108) Copyright

The horizontally rotating fluid-filled, membrane oxygenated bioreactors developed at NASA Johnson for spacecraft applications provide a powerful tool for ground-based research. Three-dimensional aggregates formed by cells cultured on microcarrier beads are useful for study of cell-cell interactions and tissue development. By comparing electron micrographs of plant seedlings germinated during Shuttle flight 61-C and in an earth-based rotating bioreactor it is shown that some effects of microgravity are mimicked. Bioreactors used in the UAH Bioreactor Laboratory will make it possible to determine some of the effects of altered gravity at the cellular level. Bioreactors can be valuable for performing critical, preliminary-to-spaceflight experiments as well as medical investigations such as in vitro tumor cell growth and chemotherapeutic drug response; the enrichment of stem cells from bone marrow; and the effect of altered gravity on bone and muscle cell growth and function and immune response depression. O.G.

A91-31150* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

AEROBIC SULFATE REDUCTION IN MICROBIAL MATS

DONALD E. CANFIELD and DAVID J. DES MARAIS (NASA, Ames Research Center, Moffett Field, CA) Science (ISSN 0036-8075), vol. 251, March 22, 1991, p. 1471-1473. National Research Council-supported research. refs
(Contract NERC-GR/3/6254)
Copyright

Measurements of bacterial sulfate reduction and dissolved oxygen (O₂) in hypersaline bacterial mats from Baja California, Mexico, revealed that sulfate reduction occurred consistently within the well-oxygenated photosynthetic zone of the mats. This evidence that dissimilatory sulfate reduction can occur in the presence of O₂ challenges the conventional view that sulfate reduction is a strictly anaerobic process. At constant temperature, the rates of sulfate reduction in oxygenated mats during daytime were similar to rates in anoxic mats at night; thus, during a 24-hour cycle, variations in light and O₂ have little effect on rates of sulfate reduction in these mats. Author

A91-31597

A MULTISUBUNIT RIBOZYME THAT IS A CATALYST OF AND TEMPLATE FOR COMPLEMENTARY STRAND RNA SYNTHESIS

JENNIFER A. DOUDNA, SANDRA COUTURE, and JACK W. SZOSTAK (Massachusetts General Hospital, Boston) Science (ISSN 0036-8075), vol. 251, March 29, 1991, p. 1605-1608. Hoechst AG-supported research. refs
Copyright

Derivatives of the sunY self-splicing intron efficiently catalyzed the synthesis of complementary strand RNA by template-directed assembly of oligonucleotides. These ribozymes were separated into three short RNA fragments that formed active catalytic complexes. One of the multisubunit sunY derivatives catalyzed the synthesis of a strand of RNA complementary to one of its own subunits. These results suggest that prebiotically synthesized oligonucleotides might have been able to assemble into a complex capable of self-replication. Author

N91-19566* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

CENTRIFUGE FACILITY CONCEPTUAL SYSTEM STUDY. VOLUME 1: FACILITY OVERVIEW AND HABITATS

ROBERT SYNNESTVEDT, ed. Oct. 1990 352 p
(NASA-TM-102860; A-90268-VOL-1; NAS 1.15:102860) Avail: NTIS HC/MF A16 CSCL 06C

The results are presented for a NASA Phase 1 study conducted from mid 1987 through mid 1989 at Ames Research Center. The Centrifuge Facility is the major element of the biological research facility for the implementation of NASA's Life Science Research Program on Space Station Freedom using non-human specimens (such as small primates, rodents, plants, insects, cell tissues). Five systems are described which comprise the Facility: habitats, holding units, centrifuge, glovebox, and service unit. Volume 1 presents a facility overview and describes the habitats - modular units which house living specimens. Author

N91-19567# Joint Publications Research Service, Arlington, VA. JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

4 Jan. 1991 44 p Transl. into ENGLISH from various Russian articles
(JPRS-ULS-91-001) Avail: NTIS HC/MF A03

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following major subject areas are covered: biochemistry, biotechnology, pharmacology/toxicology, and physiology. There are also a few abstracts presented in the areas of aerospace medicine and radiation effects on rats, mice, and plants.

N91-19572# European Space Agency, Paris (France). **FOURTH EUROPEAN SYMPOSIUM ON LIFE SCIENCES RESEARCH IN SPACE**

VALERIE DAVID, ed. Nov. 1990 599 p In ENGLISH and FRENCH Symposium held in Trieste, Italy, 28 May - 1 Jun. 1990
(ESA-SP-307; ISBN-92-9092-070-X; ETN-91-98803) Copyright
Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

One hundred and twenty-four papers presented at the fourth European Symposium on life sciences and research in space are included in this document. The following subjects are covered: human physiology and space medicine; the biological and medical program of the manned Aragatz mission on the MIR space station; cell and developmental biology; animal physiology; biotechnology and life support systems; plant biology; and the biological effects of radiation. A chairman's report introduces each of these topics.

N91-19620# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Space Biology Group.

LYMPHOCYTES ON SOUNDING ROCKETS

MARIANNE COGOLI, B. BECHLER, AUGUSTO COGOLI, N. ARENA, S. BARNI, P. PIPPIA, G. SECHI, N. VALORA, and R.

MONTI (Naples Univ., Italy) / In ESA, Fourth European Symposium on Life Sciences Research in Space p 229-234 Nov. 1990 Sponsored in part by Italian Space Agency (Contract SNRF-3-338-0-86) Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

In two experiments performed on sounding rockets the early steps of the binding of Concanavalin A (Con A) to human lymphocytes under microgravity conditions were studied. No significant difference in the binding of Con A to lymphocytes and subsequent patching and capping between the flight samples and 1 g ground control were observed. In a further experiment the effect of gravity on the cytoskeletal structure of lymphocytes was investigated. Preliminary results indicate that the structure of vimentin may be influenced by altered gravity conditions. ESA

N91-19621*# Eidgenössische Technische Hochschule, Zurich (Switzerland). Space Biology Group.

REDUCED LYMPHOCYTE ACTIVATION IN SPACE: ROLE OF CELL-SUBSTRATUM INTERACTIONS

FELIX K. GMEINDER, M. KIESS, GERALD SONNENFELD (Louisville Univ., KY.), J. LEE, and AUGUSTO COGOLI / In ESA, Fourth European Symposium on Life Sciences Research in Space p 235-238 Nov. 1990 Sponsored in cooperation with the Swiss Federal Inst. of Tech. and ESA (Contract NAG9-181) Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders CSCL 06C

The effect of substratum adhesiveness on lymphocyte responsiveness was investigated by reducing and blocking cell adhesion with poly-HEMA (poly (2-Hydroxyethyl Methacrylate)) in a simple on ground system. Cells grown on medium thick and thick poly-HEMA films were rounded in shape and displayed no signs of spreading. By contrast, on tissue culture plastic and very thin poly-HEMA films, they showed clear signs of spreading. The mitogenic response of lymphocytes grown on thick poly-HEMA films was reduced by up to 68 percent of the control (tissue culture plastic). Interferon gamma production was virtually nil when the cells were grown on the least adhesive substratum. These results show that activated lymphocytes need to anchor and spread prior to achieving an optimal proliferation response. It is concluded that decreased lymphocyte adhesion could contribute to the depressed in vitro lymphocyte responsiveness found in the microgravity conditions of space flight. ESA

N91-19622# University Coll., London (England). Mammalian Development Unit.

DEVELOPMENTAL BIOLOGY AND MICROGRAVITY

ANNE MCLAREN / In ESA, Fourth European Symposium on Life Sciences Research in Space p 239-242 Nov. 1990 Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

Experiments investigating the effects of microgravity on developmental biology, cell biology, insects and vertebrates are reviewed and those planned for the 1991 joint Anglo-Soviet space mission are presented. Microgravity is known to affect the behavior of single cells. It therefore seems unlikely that the multitude of cellular processes and interactions that make up embryonic development will not respond in some way to the absence of a gravity signal. In *Drosophila* and stick insects, Biorack experiments have suggested that microgravity may cause abnormalities at the time of hatching. The response of vertebrate development to microgravity has not yet been subjected to critical analysis, but axis formation and the establishment of polarity in amphibia and birds are known to respond to gravitational stimuli in ground based experiments. ESA

N91-19623# Hubrecht Lab., Utrecht (Netherlands).
EPIDERMAL GROWTH FACTOR INDUCED SIGNAL TRANSDUCTION IN A431 CELLS IS INFLUENCED BY ALTERED GRAVITY CONDITIONS

ROLF P. DEGROOT, PHILIP J. RIJKEN, JEROEN DENHERTOG, JOHANNES BOONSTRA, ARIE J. VERKLEIJ (Utrecht State Univ.,

Netherlands), SIEGFRIED W. DELAAT, and WIEBE KRUIJER / In ESA, Fourth European Symposium on Life Sciences Research in Space p 243-247 Nov. 1990 Sponsored by Space Research Organization Netherlands Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

Epidermal Growth Factor (EGF) activates a well characterized signal transduction cascade in human A431 epidermoid carcinoma cells. It was previously shown that EGF induced cell rounding and protooncogene c-fos expression is influenced by stimulated gravity changes. A study showing that real microgravity conditions significantly decrease EGF induced c-fos expression as well as EGF-receptor clustering is presented. Evidence that the decrease in c-fos expression is caused by a direct effect on the c-fos promoter, and that only a subset of signal transduction pathways leading to c-fos expression is sensitive to gravity changes, is provided. ESA

N91-19624# Hubrecht Lab., Utrecht (Netherlands).

FERTILIZATION OF XENOPUS EGGS IN SPACE

G. A. UBBELS, W. BERENDSEN (Utrecht State Univ., Netherlands), S. KERKVLIT, and J. NARRAWAY / In ESA, Fourth European Symposium on Life Sciences Research in Space p 249-254 Nov. 1990 Sponsored by Space Research Organization Netherlands Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

The role of gravity on developmental biology is studied. Amphibian eggs, favorable because of their small size and because they are easily obtained, are studied. Egg rotation and centrifugation experiments strongly suggest that gravity functions in the determination of the spatial structure of amphibian embryos. Decisive experiments can only be made in space. Eggs of *Xenopus laevis*, the South African clawed toad, were the first vertebrate eggs which were successfully fertilized on sounding rockets in space. Unfixed, newly fertilized eggs survived reentry, and a reasonable number showed a seemingly normal gastrulation but died between gastrulation and neurulation. Only a few became larvae, but these developed similarly abnormal. Whether this is due to reentry perturbations, a real microgravity effect, or due to other causes, will be tested in the future. ESA

N91-19625# Paris VI Univ., Banyuls-sur-Mer (France). Observatoire Oceanologique.

MICROGRAVITY AND DEVELOPMENT OF AQUATIC ANIMALS

HANS-JUERGEN MARTHY / In ESA, Fourth European Symposium on Life Sciences Research in Space p 255-257 Nov. 1990 Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

The usefulness of selected aquatic animals and their eggs, embryos, larvae and/or juveniles for microgravity studies during orbiting and non orbiting space flights is stressed for work in developmental biology research. A recently flown experiment (sounding rocket Maser 4, CIS-2, Kiruna), using sea urchins, to determine possible effects of microgravity on fertilization, is used to illustrate and support this view. ESA

N91-19626# Stuttgart Univ. (Germany, F.R.). Inst. of Zoology.
EFFECT OF HYPER-GRAVITY ON THE SWIMMING BEHAVIOR OF AQUATIC VERTEBRATES

HINRICH RAHMANN, KLAUS SLENZKA, and R. HILBIG / In ESA, Fourth European Symposium on Life Sciences Research in Space p 259-263 Nov. 1990 Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

Larvae of developing cichlid fish and clawed toads were subjected to hypergravity forces (2 to 4 G) for nine days. Upon returning to 1 G conditions, swimming was measured quantitatively in comparison to a 1 G control group by means of a computer based videographic analysis system (video track). Long term, hyper G fish and toads exhibited typical loop swimming which was performed during a habituation period of 3 to 5 days. In comparison to the control group, they preferred different locations within their mini aquaria and showed significant differences in the duration of

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their inactive periods, their fast and slow swimming movements and swimming distances. These behavioral studies serve as the basis for further neurobiological investigation and are essential to future D 2 STATEX experiments. ESA

N91-19627# Bertin et Cie., Plaisir (France).

PRELIMINARY STUDY OF A MEMBRANE BIOREACTOR FOR CELL CULTURE IN SPACE

P. BINOT, ISABELLE GEAHEL, and R. MATTOUT *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 265-267 Nov. 1990 Sponsored by CNES
Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

Cell culture in microgravity may allow a better knowledge of human physiology in space and requires development of bioreactors capable of working continuously under high cell density, without perturbation of, or by, microgravity. Among existing types of bioreactors, hollow fiber reactors appear to be the best suited in spite of the nonhomogeneity of their culture chamber. This nonhomogeneity problem could be alleviated by using flat membranes. A mathematical modeling study of the transfer parameters through a flat feeding membrane working under tangential filtration conditions shows that good transfer homogeneity could be obtained provided there is: a low ratio (filtered medium/circulating medium) (1/10 approximately); a tangential speed lower than used for ultra microfiltration (2 to 15 cm/sec approximately); a transmembrane pressure drop close to usual microfiltration levels (10,000 approximately). Experimentation on a model with miscellaneous types of membranes confirmed the above results and underlined the requirement of using well characterized membranes. Microgravity appears to have little influence on flat membrane bioreactors which are a good prospect for cell physiology experiments in space. ESA

N91-19628# Texas Univ. Health Science Center, Houston.

ALTERED CARTILAGE DIFFERENTIATION IN TIBIAL EPIPHYSEAL PLATES OF COSMOS RATS

P. J. DUKE, G. DURNOVA (Institute of Biomedical Problems, Moscow, USSR), and DINA MONTUFAR-SOLIS *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 269-273 Nov. 1990

Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

Growth plates of rats flown aboard the Soviet biosatellites Cosmos 1887 and 2044 were analyzed using light and electron microscopy, and computerized planimetry. Area was significantly less in 1887 animals and collagen fibrils in flight animals were wider than in synchronous controls. The proliferative zone of flight animals was significantly higher and had more cells/column than controls; the hypertrophic/calcification zone was significantly reduced. Reserve zone height was reduced only on 1887. The total number of cells/column was significantly higher in 1887 flight rats only. Results represent both effects of microgravity exposure and initial stages of recovery from that exposure; and confirm previous observations of altered cell proliferation, differentiation and matrix organization in growth plates exposed to microgravity. ESA

N91-19629# Naples Univ. (Italy). Inst. of Human Physiology.

EFFECT OF THE CENTRIFUGE FORCES ON PREGNANT RATS

G. DEFRANCISCIS, RICCARDO SOLIMENE, C. DONZELLI, P. GAMBARELLA, and G. P. PIZZUTI *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 275-280 Nov. 1990

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The effects of centrifuge acceleration on rats' embryos at different stages of development was analyzed. Four groups of pregnant rats, respectively in the first, second, fifth and sixth day of pregnancy, were put in the centrifuge in small plexiglass cages and were submitted to transversal acceleration of 3 G for 3 hours with 45 minutes of run and 15 minutes of rest. After this the

animals were sacrificed, the first and the second group immediately, the third and the fourth at the eighteenth day of pregnancy. The morphologic analysis showed that the application of the centrifuge acceleration at the first two days of pregnancy inhibits the development of the eggs, whereas at the fifth and the sixth day causes bad deformations. The karyotyping analysis of the foeta is in course. ESA

N91-19631# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Inst. for Aerospace Medicine.

CELLULAR FUNCTIONS OF PARAMECIUM UNDER

DIFFERENT GRAVITY CONDITIONS

RUTH HEMMERSBACH-KRAUSE, DONAT-P. HAEDER, M. KOEHLER, J. PERDIGAO (Lisbon Univ., Portugal), and WOLFGANG BRIEGLEB *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 285-290 Nov. 1990

Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

Computer analysis of the negative gravitactic behavior of *Paramecium* observed in a horizontal microscope was performed. It was found that there exists a strong (negative) correlation between oxygen concentration within the medium and the degree of gravitaxis, and, under some experimental conditions, swimming velocity. Treatment of *Paramecium* with the metabolic uncoupler CCCP had no influence on the negative gravitaxis. In another set of experiments proliferation of different strains of *Paramecium* was investigated on the clinostat. All tested strains showed larger fluctuations between cell numbers if two daughter cells were cultivated under 1 G and simulated 0 G than if both cells were cultivated under 1 G. Statistical analysis of these differences revealed a significantly higher proliferation of homozygous *P. tetraurelia* 7s under simulated 0 G. ESA

N91-19632# Institut National de la Sante et de la Recherche Medicale, Toulouse (France).

GROWTH RATE OF BACTERIA WITHOUT AND WITH ANTIBIOTIC AT DIFFERENT LEVELS OF GRAVITY

LYDIE LAPCHINE, N. MOATTI, J. P. MOATTI, G. GASSET, G. RICHOLLEY, and R. TIXADOR (Centre Hospitalier Univ. Purpan, Toulouse, France) *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 291-293 Nov. 1990

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Previous cell biology experiments performed in space are reviewed and results concerning the behavior of microorganisms (modifications of the cell growth rate, changes of antibiotic sensitivity, and structural and morphological differences), are found to be different. In order to try to explain these observed results, the cell growth rate of bacteria cultivated at different levels of hypergravity without or with subinhibitory concentrations of antibiotic (Dihydrostreptomycin) was studied. Three levels of hypergravity (2, 5, 10 G) were investigated at regular intervals (3, 5, 7, 9 hours). No significant differences were noted, for the three levels of hypergravity investigated, compared to the normal gravity of 1 G. ESA

N91-19634*# Bern Univ. (Switzerland). Anatomisches Inst.

INCREASED MITOGENIC RESPONSE IN LYMPHOCYTES FROM CHRONICALLY CENTRIFUGED MICE

OTFRIED MUELLER, E. HUNZINGER, AUGUSTO COGOLI, B. BECHLER, J. LEE, J. MOORE, and J. DUKE (Texas Univ. Health Science Center, Houston.) *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 301-305 Nov. 1990
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The effects upon the mitogenic response of splenic lymphocytes when exposing mice to prolonged hypergravity conditions (3.5 G for 1 year) were studied. Cultures of splenic lymphocytes isolated from both centrifuged and control (1 G) animals were stimulated with Concanavalin A and the response measured using both

morphological and biochemical means. Lymphocytes obtained from centrifuged mice exhibited much higher activation rates (as measured by the incorporation of H-3 thymidine) and larger cell aggregates consisting of more lymphoblasts and mitotic figures than those observed in non centrifuged control animals. Isolated splenic lymphocytes thus appear to have been conditioned by hypergravity state. ESA

N91-19635# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Inst. for Aerospace Medicine.

DOES GRAVITY PLAY A ROLE IN THE MORPHOLOGICAL DEVELOPMENT AND FUNCTION OF THE GRAVITY SENSORY ORGAN OF VERTEBRATES. DLR CONTRIBUTION TO THE D-2 PROJECT GRAVIPERCEPTION AND NEURONAL PLASTICITY, ITS TECHNICAL REALIZATION AND EXPERIMENTAL EXECUTION

JUERGEN W. NEUBERT, WOLFGANG BRIEGLEB, ALBRECHT SCHATZ, B. BROMEIS, K. BAEUMER, and P. JUNK (OHB-System G.m.b.H., Bremen, Germany, F.R.) /In ESA, Fourth European Symposium on Life Sciences Research in Space p 307-312 Nov. 1990

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Despite many investigations on the effect of gravity on the gravity sensory system of vertebrates, many questions remain unanswered. The D2 mission offers the opportunity to continue the investigation of the effects of gravity on morphogenesis, function, neuronal reaction mechanisms of the vestibular gravity receptors and behavior in aquatic vertebrates taking into account the results of the STATEX D1 experiment. The reactions will be studied on two different aquatic vertebrate species (the South African clawed toad *Xenopus laevis* Daudin and the cichlid fish *Oreochromis mossambicus*) with similar developmental profiles during the mission period. Both species allow cultivation within one commonly controlled life support system. Thus, for the first time, the development of two different aquatic vertebrates exposed to identical experimental conditions in space may be compared. ESA

N91-19636# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Inst. for Aerospace Medicine.

GRAVITY PERCEPTION BY NON-SPECIALIZED STRUCTURES
ALBRECHT SCHATZ, R. REITSTETTER, A. LINKE-HOMMES, and WOLFGANG BRIEGLEB /In ESA, Fourth European Symposium on Life Sciences Research in Space p 313-314 Nov. 1990

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Theoretical investigations indicate density variations in the membrane-solution interface which implies gravity interaction with the system. Measurements of single channel currents of gramicidin in planar phosphatidylserine bilayer membranes show a difference of about 20 percent in mean channel current between horizontally and vertically oriented bilayer membranes. These results support the theoretical predictions that the membrane solution interface is a gravity sensitive structure. ESA

N91-19637# Centre d'Etude de l'Energie Nucleaire, Mol (Belgium). Dept. of Radioprotection.

AN ASSAY FOR BONE CELL DIFFERENTIATION IN VITRO AS A TOOL FOR MICROGRAVITY STUDIES IN SPACE

GREET E. R. SCHOETERS, H. LEPPENS, F. VANDERPLAETSE, and J. MAES /In ESA, Fourth European Symposium on Life Sciences Research in Space p 315-319 Nov. 1990 Sponsored in part by DPWB/SPPS

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New bone is produced over the entire lifespan but the exact nature and localization of osteoprogenitor cells in adult tissue is unknown. This information would be essential for understanding and prevention of defects related to bone formation such as may be introduced under microgravity circumstances. The aim is to

develop an in vitro assay for differentiation of osteogenic cells which can be performed in an automated experiment container in space and evaluated after return to Earth. It has been shown that bone marrow from adult mice, cultured in vitro as an intact marrow fragment, produces bone. Cell proliferation, collagen synthesis and mineralization rate can be followed with time. This system offers the unique possibility to follow in vitro recruitment and differentiation of osteogenic cells starting from adult marrow cells. ESA

N91-19638# Stuttgart Univ. (Germany, F.R.). Inst. of Zoology.
MORPHOLOGICAL, ELECTRONMICROSCOPICAL AND BIOCHEMICAL ASPECTS OF HYPER-GRAVITY CONDITIONS DURING EARLY ONTOGENETIC DEVELOPMENT OF CICHLID FISH

KLAUS SLENZKA, R. ANKEN, A. BAEUERLE, J. H. KOERTJE, U. PAULUS, and HINRICH RAHMANN /In ESA, Fourth European Symposium on Life Sciences Research in Space p 321-328 Nov. 1990

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The effect of 2 to 4 G for a period of 9 days on the gross morphology of the brain, on various neuronal enzymes and on the ultrastructure of synaptic terminals was studied based on quantitative behavioral analysis of the effect of hypergravity on the swimming activity of fish and frog larvae. In a study of hyper G animals versus a 1 G control group the total brain volume was reduced by about 15 percent, creatine kinase activity decreased by 20 percent, there was an increase in cytochrome oxidase, there was no changes in calcium/magnesium ATPase, and there were first indications of ultrastructural changes. ESA

N91-19639# Amsterdam Univ. (Netherlands). Moleculaire Celbiologie.

UNICELLULAR ALGAE IN SPACE. 1: PREPARATORY TESTS

ANNA TOMSON, RENE DEMETS, WIES VANDENBRIEL, and HERMAN VANDENENDE /In ESA, Fourth European Symposium on Life Sciences Research in Space p 329-337 Nov. 1990 Sponsored by Space Research Organization Netherlands

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To investigate the mating process of the unicellular green alga *Chlamydomonas* in a sounding rocket, a new instrument, the flexible tube unit with a miniature illumination device was developed. For gravity independent performance of the tube unit it was necessary to equalize the buoyant density of all liquids used. Special attention was paid to the set up of the 1 G control, because mating algae tend to sink down at 1 G which appeared to affect the rate of the mating process. Further research was aimed at obtaining a proper launch window. Launch simulation tests (vibration, acceleration) were performed. ESA

N91-19640# Amsterdam Univ. (Netherlands). Moleculaire Celbiologie.

UNICELLULAR ALGAE IN SPACE. 2: SOUNDING-ROCKET EXPERIMENT

RENE DEMETS, ANNA TOMSON, WIES VANDENBRIEL, and HERMAN VANDENENDE /In ESA, Fourth European Symposium on Life Sciences Research in Space p 339-346 Nov. 1990 Sponsored by Space Research Organization Netherlands

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Complementary gametes of the alga *Chlamydomonas* were flown in the MASER-3 sounding rocket to test the influence of weightlessness on the sexual interaction of these cells. Clear cut evidence was obtained that the gametes interacted more slowly in the rocket than in the ground. Additional data indicated that the mating capability of the flown cells was reduced from the very start of the period of microgravity. It is proposed that either the cells may have been damaged by launch effects, or the cells reacted instantaneously, i.e., within seconds, to the absence of gravity. These propositions are discussed. ESA

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N91-19641# Amsterdam Univ. (Netherlands). Moleculaire Celbiologie.

UNICELLULAR ALGAE IN SPACE. 3: ADDENDUM

RENE DEMETS, ANNA TOMSON, ANNEKE NEDERBRAGT, JAAP DEWIT, and HERMAN VANDENENDE *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 347-348 Nov. 1990 Sponsored in part by Space Research Organization Netherlands

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Evidence was found that the difference between the flight samples and the ground samples in the algae experiment in MASER-3 was not caused by microgravity. This finding indicates that the current set up of cell biological microgravity experiments in sounding rockets is liable to produce erroneous data. It reinforces the idea that an on board 1 G centrifuge is necessary for obtaining unambiguous results. ESA

N91-19643# Saint-Etienne Univ. (France). Lab. de Biologie du Tissu Osseux.

BONE ADAPTATION TO REAL AND SIMULATED MICROGRAVITY

LAURENCE VICO, S. BOURRIN, J. M. VERY, D. CHAPPARD, and C. ALEXANDRE *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 359-362 Nov. 1990

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One, two and three week spaceflight missions of the Soviet Biocosmos series allowed studies of rat bone adaptation to weightlessness. Parallel to the one and two week flights, simulations were done using the Holton tail suspension model. A six week simulation was also designed to investigate long term effects. In both real and simulated microgravity conditions, results obtained from tibial proximal metaphyses at the level of the secondary spongiosa (where remodeling occurs) were compared. At the end of the first inflight week, bone loss with cellular uncoupling may constitute an acute response of bone to the new environmental condition. Later, the trabecular bone volume slowly declined due to continued impairment in bone formation while bone resorption remained normal or slightly reduced. During the first week of suspension, an acute response was observed. During the second week, a recovery phase was observed. Thereafter a slower but sustained bone loss, characterized by cellular uncoupling, took place. After one week, mechanisms of bone loss could be different. In real microgravity bone became older whereas in simulated microgravity it adapted to unloading condition by decreasing mechanical competence. ESA

N91-19645# Institute of Biomedical Problems, Moscow (USSR). **ADAPTIVE RESPONSES IN MONKEYS DURING TWO WEEK SPACE FLIGHT**

A. N. TRUZHENNIKOV, V. I. KOROLKOV, V. I. LOBACHIK, and M. A. DOTSENKO *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 367-370 Nov. 1990

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Primate studies performed during a two week space flight on board Cosmos biosatellites are discussed. These experiments have made an important contribution to resolving many tasks of space biology and medicine. Using sophisticated equipment and the subtlest methods it was possible to assess some quantitative changes in the functioning of the vestibular system, blood shifting in the body, in the dynamics of parameters of muscular function, and in metabolic changes. This allows not only a control of changes in a living organism during the initial flight stage, but a gain of greater control over adaptation to weightlessness. ESA

N91-19646# Padua Univ. (Italy). CNR Unit for Muscle Biology and Physiopathology.

CONTRACTILE PROTEIN CHANGES INDUCED BY HINDLIMB SUSPENSION IN RAT SKELETAL MUSCLE

M. CAMPIONE, G. DESALVO, S. AUSONI, C. Y. GUEZENNEC, and S. SCHIAFFINO (Centre d'Etudes et de Recherches de

Medecine Aerospatiale, Paris, France) *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 371-373 Nov. 1990

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Hindlimb suspension is used as an experimental system to simulate the effect of weightlessness on rat skeletal muscle. Previous studies show that loss of muscle mass and changes in mechanical properties induced by suspension are similar to those observed in space traveled rats. However, the molecular basis and the pathogenesis of these processes are still unclear in this study. Contractile protein changes in the rat soleus muscle were investigated after 21 days of suspension using high resolution polyacrylamide gel electrophoresis and immunoblotting analysis with monoclonal antibodies specific for Myosin Heavy Chain (MHC), troponin T and troponin I isoforms. Unloaded muscles showed a decrease in type 1 and an increase in type 2A and 2X MHC, and a parallel switching from a slow type to a fast type troponin T and troponin I isoform profile. The results indicate that conditions simulating weightlessness induce coordinated changes in the expression of contractile protein genes in rat postural muscles. ESA

N91-19647# Rome Univ. (Italy). Lab. for Experimental Neuropathology.

HINDLIMB SUSPENSION OF RABBIT FOR ONE WEEK: MYOFIBRILLAR DAMAGE IN THE SOLEUS MAY DEPEND ON LONG-LASTING SHORTENING AND PERIODIC CONTRACTION AGAINST NO LOAD

GIUSEPPE SANCESARIO, R. MASSA, A. P. ANZIL (State Univ. of New York, Brooklyn.), and G. BERNARDI *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 375-380 Nov. 1990

(Contract ASI-88-08)

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The effects of hindlimb suspension on the fine structure of the rabbit tibialis and soleus muscles was studied. The animals were suspended for one week, and the muscles were observed by light and electron microscopy. In suspension, the hindfeet were usually plantar flexed so that the length of the soleus was 35 percent shorter, and that of the tibialis was 30 percent shorter. Morphologically, while the tibialis displayed no significant changes, the soleus fibers of suspended animals showed a multifocal breakdown of the myofibrils, a marked loss in the number and a decrease in the length of the sarcomeres. Such cytoarchitectural remodeling may depend more on the shortening of the soleus against no load, rather than on the inactivity of the suspended hindlimbs. Phasic and tonic contractions without a load can also occur in the soleus of astronauts, and these factors may be detrimental to muscle structural integrity. ESA

N91-19648# Bertin et Cie., Plaisir (France).

PRELIMINARY STUDIES BEFORE DEFINING A PAYLOAD ADAPTED TO THE PRIMATE MODEL

JEAN BOQUET, MARC AUREILLE, and CLAUDE MILHAUD *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 381-385 Nov. 1990 Previously announced as N91-10107 Prepared in cooperation with Centre d'Etudes et de

Recherche de Medecine Aerospatiale, Paris, France

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A preliminary study was made before definition of a payload adapted to the primate model to be flown onboard the RRS Lifesat facility. With the prospect of an 8 week mission with a nominal load adapted to two adult rhesus monkeys or four adult cynomolgus monkeys or eight adult squirrel monkeys, the purpose of this study was to determine: the scientific objectives and constraints; the animal maintenance conditions; the functional specifications; the preliminary technical specifications; and the safety specifications. The study confirmed the scientific value of this concept and evidenced its complementarity with research carried out on man or animals onboard manned spacecraft. From a technical

standpoint, compatibility with currently proposed Lifesat program characteristics requires reducing the nominal configurations, limiting either the flight duration or the number of flown primates. ESA

N91-19649# Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge (France). Base d'Essais.

REVIEW OF EEG STUDIES IN NON HUMAN PRIMATES EXPOSED TO MICROGRAVITY

D. LAGARDE, CLAUDE MILHAUD, G. ANTON, G. CHLICK, V. MAGEDOV, and V. ROTENBERG (Institute of Biomedical Problems, Moscow, USSR) / In ESA, Fourth European Symposium on Life Sciences Research in Space p 387-391 Nov. 1990 In FRENCH; ENGLISH summary
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A review of published electroencephalographic studies on the Rhesus monkey, a privileged primate model for investigation of human sleep in microgravity, is presented. The main results from observations of Bonny (US Biosatellite 3), Gordyi Vernyi (Soviet Biocosmos 1667) and Erocha Drioma (Soviet Biocosmos 1887) are discussed. ESA

N91-19650# Vrije Univ., Amsterdam (Netherlands). Dept. of Oral Cell Biology.

HYPERGRAVITY AND BONE MINERALIZATION

JACK J. W. A. VANLOON, J. P. VELDHUIJZEN, and E. H. BURGER / In ESA, Fourth European Symposium on Life Sciences Research in Space p 393-396 Nov. 1990
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Sixteen day old fetal mice long bone rudiments were cultured under hypergravity conditions (1.0, 2.2, 2.5, and 3.1 gravity) to study growth and mineralization of the tissue. Longitudinal growth of the rudiments proceeded normally during the four day culture period. At the same time calcification of the growth plate cartilage and bone determined by the length of the diaphyses and radioactive calcium incorporation was strongly increased, by 87 and 620 percent respectively. This in vitro model allows the study of fetal bone growth, mineralization, and metabolism under increased acceleration conditions. ESA

N91-19652# Tuebingen Univ. (Germany, F.R.). Inst. of Pharmaceutical Biology.

REGENERATION AND CHARACTERIZATION OF PROTOPLAST-DERIVED CELL LINES FROM DIGITALIS LANATA EHRH. AND DIGITALIS PURPUREA L. SUSPENSION CULTURES AFTER ELECTROFUSION UNDER MICROGRAVITY CONDITIONS

THOMAS BAUMANN, W. KREIS, WERNER MEHRLE, R. HAMPP, and E. REINHARD / In ESA, Fourth European Symposium on Life Sciences Research in Space p 405-410 Nov. 1990 (Contract BMFT-01-QV-8769)
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The influence of microgravity on the yield of heterospecific fusion products after electrofusion of *Digitalis lanata* EHRH. and *Digitalis purpurea* L. (Scrophulariaceae) protoplasts was investigated. Electrofusions were performed during short time ballistic sounding rocket flights of the TEXUS 21 (1989) and TEXUS 25 (1990) missions in Kiruna, Sweden. Microgravity increased the yield of 1:1 fusion products about eightfold in comparison to terrestrial conditions. A novel feeder system was developed for the cultivation of protoplasts and their regeneration to fast growing cell lines. Two test systems proving the presence of *Digitalis* specific enzymes were employed for the detection of possible hybrids and the characterization of regenerated cell lines. ESA

N91-19662# Technische Univ., Vienna (Austria). Inst. of Plant Physiology.

PRODUCTIVITY AND PHOTOSYNTHESIS OF SELECTED CROP PLANTS UNDER ORBITAL LIGHT CONDITIONS: AN APPROACH TO SOLAR POWERED CELSS

HEIDEMARIE V. HURLT, REINHARD A. SACHER, and KARL M.

BURIAN / In ESA, Fourth European Symposium on Life Sciences Research in Space p 467-470 Nov. 1990

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Controlled ecological life support systems (CELSS) based upon higher plants might use natural sunlight rather than artificial illumination. In the case of a CELSS for a future space station in low Earth orbit (LEO), these plants would have to deal with extremely short light/dark cycles. Due to the 90 minutes revolution period of the station, plants would be subjected to 60 minutes sunlight, followed by 35 minutes darkness in shade. These orbital light/dark cycles (60 minutes/30 minutes) were simulated in a growth chamber, accompanied by control experiments under longday conditions (16 hours light/8 hours dark) in a second chamber. Biometric and gas-exchange measurements showed decreased productivity and carbon uptake in soybean (*Glycine max* L.), mung bean (*Phaseolus mungo* L.), and millet (*Sorghum bicolor* L.) under orbital light conditions. ESA

N91-19664# Celler Pflanzen- und Gewebelabor G.m.b.H., Celle (Germany, F.R.).

PLANT BIOTECHNOLOGY IN SPACE: FACTS AND SPECULATIONS

ULRICH G. LOHMANN and HILDEGARD JUNG-HEILIGER / In ESA, Fourth European Symposium on Life Sciences Research in Space p 475-479 Nov. 1990
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Chances and prospects of plant biotechnology in space are discussed from the viewpoint of a small company working with plant tissue cultures. As a fact of current space biotechnology, the possible production of new pharmaceutical metabolites by using cell cultures of medicinal plants is evaluated. The influence of microgravity on phase partition, surface tension, convection or capillarity may also be used for the development of new extraction and separation procedures for natural compounds. Thus, purity grades of plant cell metabolites may be enhanced. The role of innovative small companies in the development of highly specialized bioreactor systems for space biotechnology is illustrated. ESA

N91-19667# Bonn Univ. (Germany, F.R.). Botanisches Inst.

GRAVIPERCEPTION IN PLANTS

A. SIEVERS / In ESA, Fourth European Symposium on Life Sciences Research in Space p 491 Nov. 1990
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Graviperception in plants is discussed and the statocytes, the specialized plant cells which transduce the gravity stimulus into a physiological signal which is transmitted to that part of the organ which responds to gravity via differential flank growth, are described in detail. Statoliths may trigger the transduction mechanisms via actin filaments. Electronical responses and Ca-calmodulin are involved in stimulus transduction. References for further information are given in this one page document. ESA

N91-19668# Ohio State Univ., Columbus. Dept. of Plant Biology.

PLASTIDS AND GRAVITY PERCEPTION

FRED D. SACK / In ESA, Fourth European Symposium on Life Sciences Research in Space p 493-495 Nov. 1990
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The role of plastids in gravity sensing is discussed and results from experiments are presented. Although it has long been thought that the mass of amyloplasts triggers plant gravity perception, several starch deficient mutants (of *Arabidopsis* and *Nicotiana*) have gravitropic roots. Thus, amyloplasts and starch are not essential for gravity perception. But since roots of both mutants show significantly reduced gravitropic sensitivity it is likely that starch contributes to full sensitivity and that amyloplasts play a role in perception in wild type roots. Starch deficiency reduced gravitropism much more severely in hypocotyls than in roots. The starch deficient plastids may be the likeliest candidates to function

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in perception in mutant roots. Alternatively, another unknown system of perception might function in addition to amyloplasts.

ESA

N91-19669# Bonn Univ. (Germany, F.R.). Botanisches Inst.
GRAVITATIONAL EFFECTS ON SUBCELLULAR STRUCTURES OF PLANT CELLS

DIETER VOLKMANN and A. SIEVERS /in ESA, Fourth European Symposium on Life Sciences Research in Space p 497-501 Nov. 1990 Sponsored by BMFT and the Ministerium fuer Wissenschaft und Forschung

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Two sets of experiments performed with cress seedlings under reduced gravitational force (RGF) are described. Dry seeds were activated in orbit and grew for 32 hours under RGF. Electron microscopy of material which was chemically fixed under RGF showed remarkable differences between samples from ground controls and inflight probes. Under RGF the amount of endoplasmic reticulum (ER) membranes and lipid droplets increased up to 400 and 200 percent respectively in gravity perceiving cells, whereas the amount of starch decreased by 30 percent. Lipid droplets showed a strong tendency for confluence. In meristematic (embryonic) cells the amount of protein crystals dropped down by at least 60 percent. The number of secretory vesicles has highly increased especially in fast growing cells of the hypocotyl. Day old seedlings were launched on a sounding rocket and grew for 6 minutes under RGF. Within these 6 minutes sedimentable particles in root statocytes moved up to 3 microns in opposite direction of the originally acting gravity vector. These effects are explained by environmental stress factors including RGF.

ESA

N91-19670*# State Univ. of New York, Stony Brook. Dept. of Biochemistry and Cell Biology.

PLANT DEVELOPMENT IN SPACE: OBSERVATIONS ON ROOT FORMATION AND GROWTH

H. G. LEVINE, R. P. KANN, and ABRAHAM D. KRIKORIAN /in ESA, Fourth European Symposium on Life Sciences Research in Space p 503-508 Nov. 1990

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Root growth in space is discussed and observations on root production from plants flown as part of the Chromex project that were defined as to their origin, stage of development and physiological status, are presented. Roots were generated from fully differentiated, aseptically maintained individuals of *Haplopappus gracilis* (Compositae) under spaceflight conditions. Results are compared for tissue culture generated plantlets and comparably sized seedling clone individuals, both of which had their roots trimmed on Earth before they were loaded into NASA's plant growth unit and subjected to a 5 day shuttle flight (STS-29). Asepsis was maintained throughout the experiment. Overall root production was 40 to 50 percent greater under spaceflight conditions than during ground control tests. However, root formation slowed down towards the end of the flight. This decrease in new roots did not occur in the ground controls that sought to simulate flight except for microgravity.

ESA

N91-19671# Academy of Sciences of the Lithuanian SSR, Vilnius. Inst. of Botany.

PLANT GROWTH UNDER MICROGRAVITY CONDITIONS: EXPERIMENTS AND PROBLEMS

A. J. MERKYS /in ESA, Fourth European Symposium on Life Sciences Research in Space p 509-515 Nov. 1990

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The results of the experiments carried out during the years 1974 to 1989 on board the orbital satellites and spacecrafts with the purpose of finding out the peculiarities of growth and development of higher plants under microgravity conditions are summarized. The seed to seed growth and development of plants under microgravity conditions are shown to be feasible.

Methodological aspects of the experiments made to determine the role of gravity in the growth and development of plants are discussed. The necessity to improve research techniques is pointed out.

ESA

N91-19672# Paris VI Univ. (France).

EFFECT OF GRAVITY ON THE DISTRIBUTION OF ELECTRON DENSE CHROMATIN IN THE NUCLEUS OF ROOT STATOCYTES

G. PERBAL and DOMINIQUE DRISS-ECOLE /in ESA, Fourth European Symposium on Life Sciences Research in Space p 517-520 Nov. 1990

(Contract CNES-88/1305)

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Ultrastructural studies of the root statocyte of lentil seedlings showed that in these cells there was a polarization of the organelles with respect to the g vector. This cellular model permitted the investigation of the effects of gravity on the distribution of Electron Dense Chromatin (EDC) in the nucleus. The clustering of EDC was studied by means of a specific computer program. The texture was similar in microgravity and on the 1 g centrifuge. The distribution of EDC and that of nucleolus was different in both g conditions. It was concluded that the orientation of the nucleus depended upon gravity.

ESA

N91-19673# Erlangen-Nuremberg Univ. (Germany, F.R.). Inst. of Botany.

GRAVIOrientation IN PHOTOSYNTHETIC FLAGELLATES

DONAT-P. HAEDER and KURT VOGEL /in ESA, Fourth European Symposium on Life Sciences Research in Space p 521-526 Nov. 1990 Sponsored by BMFT

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A real time image analysis system was used to study motility and graviorientation in the flagellate, *Euglena gracilis*, before, during and after a sounding rocket (TEXUS) experiment as well as in a slow rotating centrifuge microscope (NIZEMI (German acronym)). Under 1 g conditions, the cells orient negative gravitactically and move randomly under microgravity conditions. The precision of graviorientation increases significantly at higher acceleration forces up to about 3 g in the NIZEMI and most cells were able to swim even against an acceleration vector of 4.5 g. Under microgravity conditions the velocity is about 20 percent higher than at 1 g and the swimming velocity decreases at higher acceleration forces. Gravitaxis was impaired after short exposure to UV radiation which indicates that gravitaxis may be mediated by an active physiological receptor rather than a passive physical effect.

ESA

N91-19674# Aarhus Univ. (Denmark). Inst. of Molecular Biology.

PLANT PROTOPLAST DEVELOPMENT ON BIKOSMOS 9

OLE RASMUSSEN, FELIX K. GMUENDER, M. TAIRBEKOV, E. L. KORDYUM, V. V. LOZOVAYA, C. BAGGERUD, and T.-H. IVERSEN (Trondheim Univ., Norway) /in ESA, Fourth European Symposium on Life Sciences Research in Space p 527-530 Nov. 1990 Sponsored by Danish Space Board

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The aim is to obtain information on the effects of gravity on basic cell biological processes such as growth, division and differentiation. During a 14 day space flight onboard the Soviet Biokosmos 9 satellite, the growth and development of protoplasts from rapeseed and carrots was studied and growth of protoplasts in the two different culture chambers was compared. The growth of both carrot and rapeseed protoplasts is decreased with 18 and 44 percent, respectively, after 14 days in orbit compared to the ground control. A significant decrease (46 and 29 percent) in production of cellulose was found in rapeseed and carrot, respectively. In general, developmental processes are retarded in flight samples.

ESA

N91-19675# Institut fuer Landwirtschaftliche Botanik, Bonn (Germany, F.R.).

ELECTROFUSION AND REGENERATION OF PROTOPLASTS FROM SUNFLOWER (HELIANTHUS ANNUUS L.)

URSULA BIEDINGER, P. SCHMITZ, and HEIDE SCHNABL /In ESA, Fourth European Symposium on Life Sciences Research in Space p 531-533 Nov. 1990

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These investigations contribute to the ground based studies for a D2 mission supported research in order to study membrane damage under gravity and microgravity conditions and to increase the vitality and the yield of somatic hybrids during the electrofusion process of sunflower protoplasts. Ethane, the final product of lipid peroxidation, was used as an indicator of membranous deterioration. In parallel, a suitable regeneration system for protoplasts was developed resulting in root and shoot formation.

ESA

N91-19676# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Inst. for Aerospace Medicine.

RESPONSES OF PHYSARUM POLYCEPHALUM TO VARYING LIGHT LEVELS DURING FAST CLINOSTAT ROTATION: A SCIENTIFIC PREPARATION OF AN ESA BIORACK EXPERIMENT DURING THE IML-1 MISSION

INGRID BLOCK, ANDREAS WOLKE, and WOLFGANG BRIEGLEB /In ESA, Fourth European Symposium on Life Sciences Research in Space p 535-539 Nov. 1990

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A scientific preparation of an ESA experiment during the IML 1 (International Microgravity Laboratory) mission is reported. The aim of this investigation was to repeat older experiments on the fast rotating clinostat with the slime mold *Physarum polycephalum* and to combine them with light sensitivity tests. The need to submerge the organism led to some physiological problems, which were partly overcome. The advantage of submersion for studies of effects of gravity for biological systems is discussed. The study shows that it is important to use the fast clinostat for analyzing results of cell biological experiments performed in space. ESA

N91-19677# Erlangen-Nuremberg Univ. (Germany, F.R.). Inst. of Botany.

SIMULTANEOUS TRACKING OF FLAGELLATES IN REAL TIME BY IMAGE ANALYSIS

KURT VOGEL and DONAT-P. HAEDER /In ESA, Fourth European Symposium on Life Sciences Research in Space p 541-545 Nov. 1990 Sponsored by DFG

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The hardware and software components which allow up to several hundred organisms to be tracked simultaneously, are described. Real time tracking of many microorganisms simultaneously is achieved by the hardware and software components described. Four video frames are taken at 80 millisecond intervals, digitized at a resolution of 512 by 512 pixels at 256 gray levels each and stored in a dedicated memory. The positions of all organisms are determined in the subsequent frames using the chain code algorithm and the movement vectors (direction and velocity) are calculated and stored in the form of deviation angles from a predefined stimulus direction. Subsequent programs determine circular histograms of movement directions and velocities. Examples of orientation patterns are given for both photo and gravitaxis in the dinoflagellate, *Peridinium gatunense*. ESA

N91-19678# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Inst. for Aerospace Medicine.

GRAVITAXIS IN PHYSARUM POLYCEPHALUM

ANDREAS WOLKE, WOLFGANG BRIEGLEB, and F. ACHENBACH (Bonn Univ., Germany, F.R.) /In ESA, Fourth European Symposium

on Life Sciences Research in Space p 547-549 Nov. 1990
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The aim is to develop new test conditions which affect the gravitactic behavior of *Physarum*. These investigations help to reveal information about the mechanisms of gravi-perception and the regulation of gravitaxis in single cells using *Physarum* as a model organism. The acellular slime mold *Physarum polycephalum* is discussed to be an ideal model organism to study gravity perception and the regulation of gravitaxis in single cells. Since a specialized gravity receptor has not yet been found in *Physarum* it is interesting to observe that the organism performs a clear gravity oriented locomotion. Gravitaxis in *Physarum* seems to be an actively regulated process, for the sign of the gravitaxis can be altered by varying external conditions. ESA

N91-19681# Centre National de la Recherche Scientifique, Orleans (France). Centre de Biophysique Moleculaire.

EXTRATERRESTRIAL ORGANIC MOLECULES AND THE EMERGENCE OF LIFE ON EARTH

ANDRE BRACK /In ESA, Fourth European Symposium on Life Sciences Research in Space p 565-569 Nov. 1990

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Terrestrial life can be schematically described as organic molecules organized in liquid water. According to the classical scenario, the organic building blocks required for early life were produced from simple organic molecules formed in the primitive reducing atmosphere. Amino acids, purine and pyrimidine bases, sugars, lipid like materials have been produced in the laboratory under simulating conditions. Geochemists now favor a less reducing atmosphere dominated by carbon dioxide. In such an atmosphere, very few building blocks are formed in the laboratory. Impact of extraterrestrial organic molecules may represent an alternative supply. Contemporary experimental support for such an alternative scenario will be examined at ground level (micrometeorites and meteorites), stratospheric and Earth's orbit level (cosmic dust) and interplanetary level (comets). The analysis of organic molecules in the solar system will help in understanding the emergence of life on Earth. ESA

N91-19682# Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (Germany, F.R.). Botanisches Inst.

DEFECTIVE EMBRYOGENESIS OF ARABIDOPSIS INDUCED BY COSMIC HZE-PARTICLES

U. BORK, A. R. KRANZ, S. SOMMER, M. W. IMMERMAN, and M. PICKERT /In ESA, Fourth European Symposium on Life Sciences Research in Space p 571-572 Nov. 1990 (Contract BMFT-01-QV-85650)

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Dry seeds containing embryos of the crucifer plant *Arabidopsis thaliana* (L.) Heynh. were flown in the orbit for 13 days on Biokosmos 8 and for 14 days on the Biokosmos 9 satellite. Among several biological endpoints of radiation damage the summarized damage and the mutation frequencies of embryonic lethal genes were calculated (m sub a, m sub b, and m sub c based on segregating plants, segregating siliques and total sample of embryos). In this way, for the first time a stabilized genetic defect preferentially caused by cosmic HZE particle in an eukaryotic organism is presented. It is expressed by lethal genes of embryogenesis after recombination in the offspring. ESA

N91-19683# Giessen Univ. (Germany, F.R.). Strahlenzentrum.
BIOLOGICAL ACTION OF SINGLE ACCELERATED HEAVY IONS ON INDIVIDUAL YEAST CELLS

MICHAEL KOST, JUERGEN KIEFER, and GUENTER LENZ (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany, F.R.) /In ESA, Fourth European Symposium on Life Sciences Research in Space p 573-575 Nov. 1990 Sponsored by Gesellschaft fuer Schwerionenforschung and BMFT

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51 LIFE SCIENCES (GENERAL)

Yeast cells were shown to be a suitable test organism for heavy ion irradiation experiments in space or at ground based particle accelerators. Because of the small numbers involved in space the action of single ions on individual cells has to be investigated. This is possible by computer supported image analysis. Cells are embedded in non-nutrient agar and placed on a nuclear track detector. After irradiation, the cells are incubated under growth conditions for the colony forming test. Subsequent track etching reveals the latent particle tracks. Digitized image data of specially marked areas on the track detector allow one to correlate the distance between cell and particle track with the survival probability of the specific biological object. Experiments were performed with neon, argon, xenon and uranium ions with specific energies between 8 and 14 MeV/u. Information on the correlation between particle type and absolute effectiveness, especially with respect to direct hits, can be obtained. Furthermore the influence of the impact parameter as well as the significance of ion type and energy can be studied. It was found that absolute effectiveness increases with ion charge. Penumbral effects become more significant with increasing ion energy. ESA

N91-19685# Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (Germany, F.R.). Botanisches Inst.

ARABIDOPSIS THALIANA (HEYNH.) POLLEN: A NEW TOOL IN HEAVY IONS RADIATION

M. PICKERT, A. R. KRANZ, and S. SOMMER /In ESA, Fourth European Symposium on Life Sciences Research in Space p 581-582 Nov. 1990 Sponsored by Gesellschaft fuer Schwerionenforschung
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Arabidopsis thaliana pollen was irradiated with three different accelerated heavy ions (U, Pb, Ar). The pollen vitality was measured and the cross section was calculated. A pollination with irradiation pollen on a non-irradiated male sterile mother plant was made and the next two generations investigated and screened. The results of these experiments demonstrate clearly that irradiated pollen can induce highly lethal mutants in the following generations. ESA

N91-19686# Giessen Univ. (Germany, F.R.). Strahlenzentrum.

MUTATION INDUCTION IN DRIED YEAST CELLS AFTER IRRADIATION WITH SELECTED UVC- AND UVB-WAVELENGTHS COMPARED TO SIMULATED SUNLIGHT

KARIN SCHENK, KARIN PAWLOWSKY, and JUERGEN KIEFER /In ESA, Fourth European Symposium on Life Sciences Research in Space p 583-585 Nov. 1990
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Since UV induces a variety of photolesions, the mutagenic action in eukaryotic cells is still an important question. Being simple eukaryotic cell systems, yeast cells are suitable organisms for mutation studies, also under space conditions. Yeast cells of different repair capacities were exposed to natural solar UV light during the European EURECA mission. The involvement of repair processes after irradiation under space conditions was studied. Because of the long flight duration dried yeast cells had to be used. Laboratory studies consisted of exposure to monochromatic light between 160 nm and 313 nm as well as irradiation with simulated sunlight. Action spectra for survival and mutation induction were determined. Comparison of the whole spectrum irradiation to single wavelength exposure demonstrates the mutagenic potential of simulated sunlight. ESA

N91-19690# Saint-Etienne Univ. (France). Lab. de Biologie du Tissu Osseux.

ARAGATZ MISSION: BONE DENSITOMETRIC RESULTS OBTAINED WITH THE SCOOP MINISCANNER

C. ALEXANDRE, J. F. POUGET, LAURENCE VICO, and P. RUEGSEGGER (Eidgenossische Technische Hochschule, Zurich, Switzerland) /In ESA, Fourth European Symposium on Life Sciences Research in Space p 609-610 Nov. 1990

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Densitometry equipment which, by measuring the alternation of monoenergetic x rays, makes it possible to appreciate the calcium mass of two peripheral bones, the tibia and radius, is discussed with reference to investigating the occurrence of weightlessness induced osteoporosis. The peripheral calcium mass (tibia and radius) was measured before and after a 28 day space flight at both proximal and distal sites. None of the results obtained were significant although there was a tendency towards an increase in calcium mass in the distal area of the right radius. It is thought that there is a calcium transfer from non-weightbearing towards weightbearing bones in order to balance the body calcium density. Recommendations for future research are given. ESA

N91-19696# Giessen Univ. (Germany, F.R.). Strahlenzentrum. **POTENTIALS, MESSAGE AND CHALLENGES OF LIFE SCIENCE RESEARCH IN SPACE**

JUERGEN KIEFER /In ESA, Fourth European Symposium on Life Sciences Research in Space p 639-642 Nov. 1990
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The question of whether life science research in space can contribute to the solution of fundamental biological questions is considered. The possibility of this may seem absurd considering how hostile the space environment is to living things. The lack of atmosphere and low temperatures can be overcome technically by comparatively simple means, but radiation and microgravity remain. The possible influences of microgravity on basic biological processes is considered and several achievements and promises of space biology demonstrated in papers at the conference are discussed. ESA

N91-19697# National Aeronautics and Space Administration, Washington, DC.

THE 1989-1990 NASA SPACE BIOLOGY ACCOMPLISHMENTS

THORA W. HALSTEAD, ed. Feb. 1991 226 p Prepared in cooperation with George Washington Univ., Washington, DC (Contract NASW-4324)
(NASA-TM-4258; NAS 1.15:4258) Avail: NTIS HC/MF A11 CSDL 06C

Individual technical summaries of research projects on NASA's Space Biology Program for research conducted during the period May 1989 to April 1990 are presented. This program is concerned with using the unique characteristics of the space environment, particularly microgravity, as a tool to advance the following: (1) knowledge in the biological sciences; (2) understanding of how gravity has shaped and affected life on the Earth; and (3) understanding of how the space environment affects both plants and animals. The summaries for each project include a description of the research, a list of accomplishments, an explanation of the significance of the accomplishments, and a list of publications. DOE

N91-19698# Lawrence Livermore National Lab., CA.

AN INTRODUCTION TO BIOLOGICAL DOSIMETRY

M. L. MENDELSON Oct. 1990 12 p Presented at the International Symposium on Trends in Biological Dosimetry, Lerici, Italy, 23-27 Oct. 1990
(Contract W-7405-ENG-48)
(DE91-007125; UCRL-JC-104810-REV-1; CONF-9010249-3-REV-1) Avail: NTIS HC/MF A03

In the mode of therapeutic medicine and pharmacology, biological dosimetry is the refinement of delivered chemical or physical dose by observation and measurement of the subject for the purpose of understanding treatment variables, individualizing treatment, minimizing toxicity and maximizing therapeutic effect. In the mode of toxicology and biological research biological dosimetry is a general strategy to pursue cause and effect relationships across subjects, doses and species, to understand and generalize the mechanisms of biological damage, and to predict and prevent ultimate toxic effects. In the mode of epidemiology and human biology, biological dosimetry is the retrospective reconstruction of

dose in occupationally, environmentally and medically exposed subjects in order to identify human toxins, to study human toxicology, to improve human risk assessment, to identify unusual human susceptibilities, to provide independent evidence of exposure or risk, and to understand the nature of human disease.

DOE

N91-19699*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

PREDICTIONS OF CELL DAMAGE RATES FOR LIFESAT MISSIONS

FRANCIS A. CUCINOTTA, WILLIAM ATWELL, ALVA C. HARDY, MICHAEL J. GOLIGHTLY, JOHN W. WILSON, LAWRENCE W. TOWNSEND, JUDY SHINN, JOHN E. NEALY, and ROBERT KATZ (Nebraska Univ., Lincoln.) Nov. 1990 14 p (NASA-TM-102170; S-616; NAS 1.15:102170) Avail: NTIS HC/MF A03 CSDL 06C

The track model of Katz is used to make predictions of cell damage rates for possible Lifesat experiments. Contributions from trapped protons and electrons and galactic cosmic rays are considered for several orbits. Damage rates for survival and transformation of C3HT10-1/2 cells are predicted for various spacecraft shields.

Author

N91-19700*# Lockheed Engineering and Sciences Co., Washington, DC.

USSR SPACE LIFE SCIENCES DIGEST. INDEX TO ISSUES 26-29

LYDIA RAZRAN STONE, ed. Washington NASA Mar. 1991 103 p

(Contract NASW-4292)

(NASA-CR-3922(35); NAS 1.26:3922(35)) Avail: NTIS HC/MF A06 CSDL 06C

This bibliography provides an index to issues 26 through 29 of the USSR Space Life Sciences Digest. There are two sections. The first section lists bibliographic citations of abstracts in these issues, grouped by topic area categories. The second section provides a key word index for the same abstracts. The topic categories include exobiology, space medicine and psychology, human performance and man-machine systems, various life/body systems, human behavior and adaptation, biospherics, and others.

Author

N91-19701*# Louisville Univ., KY. Dept. of Microbiology and Immunology.

COSMOS: 1989 IMMUNOLOGY STUDIES Semiannual Progress Report No. 3, Oct. 1990 - Mar. 1991

GERALD SONNENFELD 1991 46 p

(Contract NAG2-614)

(NASA-CR-188046; NAS 1.26:188046) Avail: NTIS HC/MF A03 CSDL 06C

The effects of flight on Cosmos mission 2044 on leukocyte subset distribution and the sensitivity of bone marrow cells to colony stimulating factor-GM were determined. A parallel study with antiorthostatic suspension was also carried out. The study involved repetition and expansion of studies performed on Cosmos 1887. Spleen and bone marrow cells were obtained from flown, vivarium control, synchronous control, and suspended rats. The cells were stained with a series of monoclonal antibodies directed against rat leukocyte cell surface antigens. Control cells were stained with a monoclonal antibody directed against an irrelevant species or were unstained. Cells were then analyzed for fluorescence using a FACSCAN flow cytometer. Bone marrow cells were placed in culture with GM-CSF in McCoy's 5a medium and incubated for 5 days. Cultures were then evaluated for the number of colonies of 50 cells or greater.

Author

N91-19702# California Univ., Berkeley. Dept. of Plant Pathology.

CHARACTERIZATION OF A DEFECTIVE INTERFERING RNA THAT CONTAINS A MOSAIC OF A PLANT VIRAL GENOME

T. J. MORRIS and A. O. JACKSON 1990 6 p

(Contract DE-FG03-88ER-13908)

(DE91-007897; DOE/ER-13908/2) Avail: NTIS HC/MF A02

This research addresses the identification of viral sequences important in viral pathogenicity through the molecular characterization of a unique class of symptom modulating RNAs called defective interfering RNAs (DI RNAs). DI RNAs are linear deletion mutants of viral genomes that complete with and interfere with the helper virus thus reducing the severity of the disease. Although DIs are common components of animal virus infections, they are uncommon in plant infections. We have identified DIs in association with turnip crinkle virus (TCV). To evaluate the essential sequences of the DI RNAs, we have completely cloned and sequenced the helper virus genomes and have begun to investigate the origin and evolution DI RNAs which arise de novo when host plants are inoculated with RNA transcripts derived from complete clones of the viral genomes. We have also developed a procedure to permit rapid cloning, sequencing and the evaluation of the biological activity of DI RNAs using PCR amplification methods. To address the mechanism of virus-host interactions leading to symptom attenuations, we have used molecular probes to study the replication and interference effects of DIs in plants and protoplasts. In addition, we are in the process of constructing plasmids to permit the expression of DIs in transgenic tomatoes with the longer term goal of constructing plants with engineered resistance to plant viruses.

DOE

N91-19703# California Univ., Berkeley. Dept. of Plant Pathology.

CHARACTERIZATION OF A DEFECTIVE INTERFERING RNA THAT CONTAINS A MOSAIC OF A PLANT VIRAL GENOME

T. J. MORRIS and A. O. JACKSON 1990 6 p

(Contract DE-FG03-88ER-13908)

(DE91-007898; DOE/ER-13908/3) Avail: NTIS HC/MF A02

Our lab was the first to describe and characterize a defective interfering RNA (DI RNAs or DIs) in association with a small RNA plant virus (Hillman et al., 1987). The features of the DIs that we discovered in infections of tomato bushy stunt virus were compatible with the properties of DIs identified in many animal virus infections. Hence our discovery offered a comparably valuable tool for use in plant virus studies for the first time. Since then, we have also discovered the second example of plant viral DI RNAs associated with turnip crinkle virus (TCV), a virus structurally related to TBSV (Li et al., 1989). We had demonstrated that the DIs were collinear deletion mutants of the genome of a cherry strain of tomato bushy stunt virus (TBSV). We had also shown that these low molecular weight RNAs interfered with the helper plant virus and modulated disease expression by preventing the development of a lethal necrotic disease in susceptible host plants. We also suggested that by exploring the mechanisms associated with the symptom attenuation effect, we might be able to devise novel strategies useful for engineering viral disease resistance. Recent results establishing TBSV as the likely etiologic agent of tomato plant decline lends urgency to such application in view of the serious nature of this disease problem in the irrigated desert areas of California (Gerik and Duffus, 1989). To accomplish this, we defined 5 major objectives for the grant period. We have completed three of the proposed research objectives and have made substantial progress on the other two. A reiteration of each of the proposed objectives follows along with a brief statement of the specific accomplishments completed or expected to be completed before the end of the grant period. Additional details of the research are provided in the attached reprints and preprints.

DOE

N91-19704# Pacific Northwest Lab., Richland, WA. **BIOLOGICAL EFFECTS OF EXTREMELY LOW-FREQUENCY ELECTROMAGNETIC FIELDS: IN VIVO STUDIES**

L. E. ANDERSON Jan. 1991 57 p Presented at the Scientific Workshop on Health Effects of Electromagnetic Radiation on Workers, Cincinnati, 30-31 Jan. 1991

(Contract DE-AC06-76RL-01830)

(DE91-007899; PNL-SA-19017; CONF-910184-1) Avail: NTIS HC/MF A04

Until the last few decades, the natural background levels of atmospheric electric and magnetic fields were extremely low; however, they have since dramatically increased. The industrialization and the electrification of society have resulted in the exposure of people, animals and plants to a complex milieu of elevated electromagnetic (EM) fields that span all frequency ranges. In the past two decades, research programs throughout the world have greatly expanded in scope and depth to address such issues. Significant progress has been achieved, both in defining the ways living organisms interact with ELF fields and in describing biological effects, both real and potential, from such fields. Much of this effort has been directed toward electric fields of power frequencies. However, frequencies other than 50 and 60 Hz have also been examined, and research has been expanded to include magnetic as well as electric fields. Although it is now clear that ELF EM fields do cause biological effects, the basis for those effects and the underlying mechanisms of interaction remain largely unknown, and the health implications for humans and animals have yet to be fully determined. This paper specifically examines the biological effects of exposure to ELF EM fields observed in *in vivo* (animal) studies. An attempt is made to evaluate experimental results and, insofar as possible, interpret them with respect to potential health implications. An overview of current concepts and possible mechanisms is given, and possible future directions of research are discussed. DOE

N91-19705# Utah Univ., Salt Lake City. Radiobiology Div.
RESEARCH IN RADIOBIOLOGY: WORK IN PROGRESS IN IMMUNOBIOLOGY OF EXPERIMENTAL HOST-TUMOR RELATIONSHIPS Annual Report

15 Jan. 1991 8 p
 (Contract DE-FG02-89ER-60836)
 (DE91-007936; DOE/ER-60836/2) Avail: NTIS HC/MF A02

Immunogenic or regressive tumors demonstrate high constitutive or inducible levels of MHC expression, while most virulent, aggressive tumors exhibit a low level of MHC Class 1 expression. Results with UVR-induced tumors suggest that a significant role is played by the T-cell lymphokine, gamma-interferon (gamma-IFN), in the modulation of MHC molecule expression *in vivo*. Virulent tumors induced by bone-seeking radionuclides may be refractory to gamma-IFN stimulation of MHC molecule expression. In contrast, any regressive tumors might be highly responsive to gamma-IFN, increase MHC expression, and consequently display an immunogenic phenotype. Alternatively, it is also possible that some tumors might be fully responsive to the Class 1 modulatory influences of gamma-IFN, but lack the capacity to stimulate synthesis of this lymphokine by host T cells. We presented experiments designed to: (1) describe the virulence, latency period, and transplantation characteristics of Pu-238, Am-241, and Th-228 tumors arising as osteogenic sarcomas and hepatic carcinomas, (2) determine the relationship between inducible expression of MHC Class 1 molecules by gamma-IFN and *in vivo* immunogenicity of these radioisotope-induced tumors, and (3) elucidate any molecular mechanisms responsible for a lack of responsiveness to gamma-IFN or a failure to induce host gamma-IFN production exhibited by virulent tumors. Our study has also been designed to determine whether the immunologic status of a prospective host, plays any role in the susceptibility to, the induced malignancies. Our proposal will test these relationships in tumor biology using Pu-238, Am-241, Th-228 induced bone and liver tumors in a syngeneic rodent system. DOE

N91-19706# Utah Univ., Salt Lake City. Dept. of Human Genetics.

ADVANCED SEQUENCING TECHNOLOGY

R. F. GESTELAND 15 Jan. 1991 8 p
 (Contract DE-FG02-88ER-60700)
 (DE91-008031; DOE/ER-60700/3) Avail: NTIS HC/MF A02

The multiplex method of sequencing DNA has made progress on a number of fronts. A new method of organizing the DNA input for large, cosmid size, sequencing projects has been developed. It uses transposons to rapidly and easily make a large number of random inserts in a cosmid. The transposon contains

primer sequences and identifier senses for multiplexing, going out in both directions from the transposon with the result that multiplexed sequencing from these gives twice the length of read. Fast ways of mapping the random inserts are being developed so that the minimal overlapping set can be identified. Mini-pilot projects have been run including one on genomic sequences in the region of the neurofibromatosis gene in collaboration with Ray White's group. This genomic sequencing played a key role in the identification of this disease gene. A new algorithm for reading gel patterns into DNA sequence using communication theory is being developed and tested. We are continuing work on chemiluminescent detection of sequencing patterns via multiplex probes. The sensitivity looks very good but the problems of reprobing and CCD detection are not fully solved. DOE

N91-19707# California Univ., Davis. Dept. of Bacteriology.
PHYSIOLOGICAL GENETICS OF DENITRIFICATION: A ROUTE TO CONSERVING FIXED NITROGEN

1991 6 p
 (Contract DE-FG03-85ER-13356)
 (DE91-008157; DOE/ER-13356/T2) Avail: NTIS HC/MF A02

Biological denitrification is the reduction of nitrate or nitrite ions to gaseous species, either nitrous oxide (N₂O) or dinitrogen. This is the only significant process by which fixed nitrogen is removed from the environment. Mutant strains of *Pseudomonas stutzeri* (P. stutzeri) which cannot catalyze the denitrification reaction are being studied. The strain studied, nosA, has a defect in the nosA gene, which doesn't code for N₂O reductase. Since the N₂O reductase from nosA bacteria contains less than 4% of the copper found in wild-type N₂O reductase, nosA 13 is believed to code for an enzyme which inserts copper into N₂O reductase. NosA protein is found in the outer membrane of P. stutzeri, and N₂O reductase is located in the periplasm. Synthesis of nosA, but not N₂O reductase is sensitive to exogenous copper concentrations. NosA protein was isolated and purified, and used to make a polyclonal antisera Western blots shown the sera reacts with nosA protein. Labelling live P. stutzeri with Cu-67, three copper containing proteins were identified. N₂O reductase and nosA protein were two of the three; the identity of the third is not known, but it is not believed to be superoxide dismutase. Two strains of phage specific for wild type nosA protein have been isolated. The antibodies generated are being used with an expression library to clone the nosA gene. So far, about half of the gene has been cloned. In related work, the kinetics of synthesis of proteins specific for aerobic or anaerobic conditions are described. Three proteins which are synthesized in response to anaerobic conditions and two proteins whose synthesis requires aerobic conditions are described. DOE

N91-19708# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (Germany, F.R.). Dienstleistungsbereich.

EXPERIMENTAL EQUIPMENT FOR SPACE BIOLOGY

J. SCHAUWER and J. WARRELMANN (Erno Raumfahrttechnik G.m.b.H. Bremen, Germany, F.R.) 1990 12 p Presented at the 17th ISTS, Tokyo, Japan, 20-25 May 1990
 (MBB-UO-0096-90-PUB; ETN-91-98833) Avail: NTIS HC/MF A03

A facility BLUME (Biological Support Unit for Microgravity Experiments) for biological investigations in space is described. BLUME is an autonomous facility for biological and gravitational biology experiments with controlled life support equipment which will be integrated into a container of the NASA GAS program. The components of the facility BLUME are mounted within a cylindrical structure with a height of 710 mm a diameter of 480 mm on two mounting plates. On the lower platform a supply unit is fixed consisting of a 28 V AgZn battery as power supply and an experiment control, data acquisition and signal conditioning unit. The second platform carries the life support system. This system consists of an air control loop, a water supply loop, a fixation loop, CO₂ and O₂ supply and a drying loop. These are illustrated and described. Gas exchange measurements and plant experiments have been performed. Future aspects are considered. ESA

N91-19709# Emory Univ., Atlanta, GA. School of Medicine.
**SUBCELLULAR SIGNAL TRANSDUCTION SYSTEMS IN THE
 CELLULAR TRAUMA OF ISCHEMIA Annual Report, Nov. 1988
 - Nov. 1990**

ALFRED H. MERRILL, JR. 24 Nov. 1990 15 p
 (Contract N00014-89-J-1027)
 (AD-A229876) Avail: NTIS HC/MF A03 CSCL 06/5

The formation of sphingosine, a potent inhibitor of protein kinase C, has been characterized in cell models of interest to studies of hypoxic and ischemic injury. With J775 macrophages, we find that sphingosine is released in an acidic compartment and is inhibitable by ammonium ion, an agent that is well known to accumulate during ischemia. The increase in sphingosine is correlated with inhibition of protein kinase C; therefore, these findings may provide a link between changes in ammonia in vivo and alteration in cell function. GRA

N91-20026*# Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.

**CARBON DIOXIDE AND WATER EXCHANGE OF A SOYBEAN
 STAND GROWN IN THE BIOMASS PRODUCTION CHAMBER**
 KENNETH A. COREY /n NASA, John F. Kennedy Space Center,
 Research Reports: 1990 NASA/ASEE Summer Faculty Fellowship
 Program p 115-141 Sep. 1990
 (Contract NGT-60002)
 Avail: NTIS HC/MF A23 CSCL 06/3

Soybean plants were grown under metal halide lamps in NASA's biomass production chamber (BPC). Experiments were conducted to determine whole stand rates of carbon dioxide exchange and transpiration as influenced by time of day, CO₂ concentration, irradiance, and temperature. Plants were grown at a population of 24 plants/sq m, a daily cycle of 12 hr light/12 hr dark, and average temperature regime of 26 C light/20 C dark, and a CO₂ concentration enriched and maintained at 1000 ppm during the photoperiod. A distinct diurnal pattern in the rate of stand transpiration was measured at both ambient and enriched (1000 ppm) concentration of CO₂. Data generated in this study represent true whole stand responses to key developmental and environmental variables and will be valuable in database construction for future working CELSS. Crop growth studies in the BPC were conducted with a high degree of environmental control, gas tightness during growth, and have used large plant stands. These characteristics have placed it in a unique position internationally as a research tool and as a preprototype subcomponent to a fully integrated CELSS. The results from the experiments are presented. Author

N91-20605# Baylor Coll. of Medicine, Houston, TX. Div. of Neuroscience.

**A STUDY OF NEURONAL PROPERTIES, SYNAPTIC
 PLASTICITY, AND NETWORK INTERACTIONS USING A
 COMPUTER RECONSTITUTED NEURONAL NETWORK
 DERIVED FROM FUNDAMENTAL BIOPHYSICAL PRINCIPLES**
Semiannual Progress Report, Dec. 1989 - Jun. 1990

DAVID C. TAM 14 Jun. 1990 5 p
 (Contract N00014-90-J-1353)
 (AD-A230476; BCM-NS-CNS-90-001) Avail: NTIS HC/MF A01
 CSCL 02/5

The computer models simulating the biophysical properties of neurons are being implemented on the Macintosh IIci computer. The coding of the neural simulator programs MacNeuron and MacNerveNet have initiated. The software has gone through the design phase, and is now in the development phase. Based on careful analysis, the design decision was made to implement the neural simulators using object-oriented programming language over the traditional procedural programming language. The choice of Object Pascal language will facilitate future adaptation and modification of the simulators to incorporate newly discovered biophysical properties of neurons in the model without extensively re-writing the programs. Since object-oriented codes are modular in design, the program can also implement the plastic changes of synaptic substrates in a well structured organization. The various membrane ionic channels are implemented as objects in the same

class, which have similar but unique (biophysical) properties. Thus, a class library can be created to form a collection of different ionic conductance channels, were new (user-specified) channels can be added to the class library. They can be incorporated into the neural simulators easily using the inheritance-properties of superclass and subclass provided by object-oriented languages. Modules of the programs are written representing the internal structure of the neural models. GRA

N91-20606# Baylor Coll. of Medicine, Houston, TX. Div. of Neuroscience.

**A STUDY OF NEURONAL PROPERTIES, SYNAPTIC
 PLASTICITY, AND NETWORK INTERACTIONS USING A
 COMPUTER RECONSTITUTED NEURONAL NETWORK
 DERIVED FROM FUNDAMENTAL BIOPHYSICAL PRINCIPLES**
Semiannual Progress Report, Jun. - Dec. 1990

DAVID C. TAM 14 Dec. 1990 6 p
 (Contract N00014-90-J-1353)
 (AD-A230477; BCM-NS-CNS-90-002) Avail: NTIS HC/MF A02
 CSCL 12/5

The neural simulator program MacNeuron is currently implemented on the Macintosh IIci computer with executable versions using either the Motorola 68020 or 68000 processor and with or without the Motorola 68881 math co-processor. A preliminary version of the program showing some features of the user-interface compiled with the 68020/68881 options is included with the progress report. A preliminary user manual is also included which describes the execution environment of the program. Currently, the program consists of more than 15,000 lines of Pascal code, and the program is still in its development and testing stages where more codes will be generated and modified. The program is written in Object Pascal using the THINK Pascal compiler incorporating the class-structure of the THINK Class library for building the neuron-class structure. Since substantial efforts have been put into designing a generalized generic neuronal stimulator for realistic neuron simulation, it becomes more apparent that the same simulation program can encapsulate the similar structure of an integrate-and-fire reduced model of the MacNerveNet into one single hybrid model program as envisioned in the original grant proposal is taken into account in the design of the MacNeuron program. Independent efforts to develop the MacNerveNet program has been re-directed to incorporate the program into MacNeuron to maximize the program development results. GRA

N91-20607# Federal Aviation Administration, Washington, DC. Office of Aviation Medicine.

**INHALATION TOXICOLOGY 10 TIMES TO INCAPACITATION
 FOR RATS EXPOSED CONTINUOUSLY TO CARBON
 MONOXIDE, ACROLEIN, AND TO CARBON
 MONOXIDE-ACROLEIN MIXTURES**

CHARLES R. CRANE, DONALD C. SANDERS, and BOYD R. ENDECOTT Dec. 1990 26 p
 (AD-A230639; DOT/FAA/AM-90/15) Avail: NTIS HC/MF A03
 CSCL 06/11

Laboratory rats were exposed to experimental atmospheres of the following: (1) carbon monoxide (CO) in air; (2) acrolein in air; and (3) mixtures of CO and acrolein in air. The toxic potency of each of the three types of environments was evaluated toxicokinetically by measurement of time-to-incapacitation, $t_{(sub\ i)}$, as a function of toxic gas concentrations. Regression equations were derived that relate the observed $t_{(sub\ i)}$'s to the concentrations of individual gases. Comparison of the combined-gas-exposure data with results obtained from the individual gas exposures indicated that there was no evidence of synergistic action, i.e., that the effect of the combination was never greater than that predicted by the sum of the two individual gas effects. Evidence did exist for an inhibitory or antagonistic effect of undefined mechanism when acrolein was present in the mixture at concentrations of lesser toxic potency than that of CO. An empirical equation was derived that allows the calculation of a predicted $t_{(sub\ i)}$ for combinations of CO and acrolein concentrations within the ranges utilized in the experimental exposures. GRA

AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

A91-28575* Brigham and Women's Hospital, Boston, MA.

LIGHT-INDUCED SUPPRESSION OF ENDOGENOUS CIRCADIAN AMPLITUDE IN HUMANS

MEGAN JEWETT, CHARLES A. CZEISLER (Brigham and Women's Hospital, Boston, MA), and RICHARD E. KRONAUER (Harvard University, Cambridge, MA) *Nature* (ISSN 0028-0836), vol. 350, March 7, 1991, p. 59-62. Research supported by NASA and NIH. refs

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A recent demonstration that the phase of the human circadian pacemaker could be inverted using an unconventional three-cycle stimulus has led to an investigation of whether critically timed exposure to a more moderate stimulus could drive that oscillator toward its singularity, a phaseless position at which the amplitude of circadian oscillation is zero. It is reported here that exposure of humans to fewer cycles of bright light, centered around the time at which the human circadian pacemaker is most sensitive to light-induced phase shifts, can markedly attenuate endogenous circadian amplitude. In some cases this results in an apparent loss of rhythmicity, as expected to occur in the region of singularity. C.D.

A91-30551

CHANGES IN OTOLOGICAL SURGERY AND IN THE MANAGEMENT OF RHINITIS

P. F. KING (Paddocks Hospital, Princes Risborough, England) *Aviation Medicine Quarterly* (ISSN 0951-3949), vol. 3, no. 1, 1991, p. 6-10.

Copyright

This paper overviews changes introduced in the last ten years in the management of otosclerosis and of allergic and vasomotor rhinitis, both conditions being significant in determining the fitness of present and future aviators. Special attention is given to new techniques in otological surgery and in medical treatment of otosclerosis and to the use of cadaver homografts in tympanoplasty for chronic suppurative otitis media. The relative values of different forms of medical treatment available for rhinitis, including the antihistaminics, antiallergic preparations, anticholinergic agents, corticosteroids, and surgical treatment, are assessed. I.S.

A91-30552

MRS - THE CAA COMPUTERISED MEDICAL RECORDS SYSTEM

R. A. PEARSON (Civil Aviation Authority, Gatwick, England) *Aviation Medicine Quarterly* (ISSN 0951-3949), vol. 3, no. 1, 1991, p. 11, 12.

Copyright

A basic paper-filing system for aircrew medical records was becoming unmanageable due to size and was difficult to use for research projects. In conjunction with a total review of the medical records, an individually designed computerized data base was implemented and now allows screening of all records against standards. Although still at an early stage, the size of the data base (62,000 records) makes it an invaluable tool for the future statistical review of aircrew. Author

A91-30554

SUPRAVENTRICULAR ARRHYTHMIAS IN FLYING PERSONNEL

GERARDO CANAVERIS (National Institute of Aviation and Space Medicine, Buenos Aires, Argentina) and M. SUSANA HALPERN (Ramos Mejia Hospital, Buenos Aires, Argentina) *Aviation Medicine Quarterly* (ISSN 0951-3949), vol. 3, no. 1, 1991, p. 22-27. refs

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The evolutive characteristics as well as the certification criteria applied in 48 cases of supraventricular arrhythmias detected in a civilian flying population of 8622 male individuals (prevalence: 0.56 percent) in Argentina were studied. They were considered in two main groups: those with normal heart rate and no pauses and those capable of reaching high heart rates. The underlying pathologies or causes capable of triggering the arrhythmias were assessed. Episodes of paroxysmal atrial flutter or atrial fibrillation imply risks; to be recertified, the episodes must be asymptomatic, must not be recurrent, and may not require any medication that may represent a flying hazard. Mitral valve disease, coronary heart disease, anomalous pathway, and thyrotoxicosis must be excluded. A waiver may be granted with periodical cardiovascular check-up. Chronic atrial flutter or fibrillation are not subject to a waiver. The ectopic rhythms currently named 'junctional rhythms' only require follow-up and may be fully certified. Author

A91-30555

ISCHAEMIC HEART DISEASE AND FITNESS TO FLY - THE CHANGING SCENE

D. A. CHAMBERLAIN (Royal Sussex County Hospital, Brighton, England) *Aviation Medicine Quarterly* (ISSN 0951-3949), vol. 3, no. 1, 1991, p. 28-30.

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Guidelines are presented for licensing and relicensing of aircrew with proven or suspected coronary artery disease. The risk factors that are traditionally considered to be important predictors of the short-term risk are evaluated, and it is shown that a minor coronary disease is a better predictor of a major coronary event than are conventional risk factors. It is emphasized however that, in view of the fact that an airline might have invested more than \$500,000 in a training program, the risk factors should be important determinants in initial medical examinations of potential recruits. Risk factors alone should not be viewed as major determinants of fitness to fly for existing pilots. The paper discusses the procedures used in the noninvasive investigation of pilots with suspected heart disease and relicensing of pilots after a myocardial infarction, a coronary surgery, and after an angioplasty. I.S.

A91-30557

RELATIONSHIP BETWEEN DIFFERENT TYPES OF AEROPLANE AND SMALL AIRWAYS FUNCTION OF AIRCREW

MAA LI MING, HUANG XIAN ZHANG, DING SI QUAN, YANG LI NA, and LUAN XIANG NING (General Hospital of Air Force, Beijing, People's Republic of China) *Aviation Medicine Quarterly* (ISSN 0951-3949), vol. 3, no. 1, 1991, p. 38-40. refs

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The aim of this paper is to observe if there is any influence on small airways function of aircrew flying different types of aircraft. Maximal expiratory flow-volume curves were compared in 110 fighter and 126 transport aircrew. The result showed that the maximal expiratory flow of the middle vital capacity, v50, v25, and v25/height of fighter aircrew were significantly lower than those of transport aircrew (p greater than 0.05-0.01). PF and v50/v25 were not significantly different (p greater than 0.05). It is suggested that some factors in the flying environment of fighter aircraft may impair the small airways function more than those of transport aircraft. Author

A91-30584

MEDICAL SUPPORT ON MIR

A. D. EGOROV, A. I. GRIGOR'EV, and V. V. BOGOMOLOV (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) *Space* (ISSN 0267-954X), vol. 7, Mar.-Apr. 1991, p. 27, 29.

Copyright

Medical support available on long-term flights aboard Mir is considered. Support is available in order to keep the crew physically and mentally fit for peak performance while in space and to minimize any physical complications that might arise during reentry. Regular medical examinations are carried out and continuous monitoring is performed at the powered stages of flight and during the preparation and conduct of EVA. Countermeasures currently used during missions to prevent body adaptation to microgravity

are discussed. These include physical exercises, specific drugs, effects regulating nutrition and fluid content of the body, optimization of the environmental parameters such as work/rest cycles and psychological support measures, readaptation to earth's gravity using lower body negative pressure leotards and anti-g suits, and muscle electrostimulation. Problems associated with prolonged exposure to the microgravity environment, such as fluid displacement and calcium loss, are discussed. L.K.S.

A91-31438

SIGNIFICANCE OF DELAYED SYMPTOM ONSET AND BUBBLE GROWTH IN ALTITUDE DECOMPRESSION SICKNESS

ROBERT M. OLSON and ROBERT W. KRUTZ (Krug International Corp., San Antonio, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, April 1991, p. 296-299. USAF-sponsored research. refs
Copyright

In vitro techniques were used to measure bubble growth at various altitudes. Decompression sickness (DCS) symptoms caused by bubble formation are considered and explained. Bubble growth requires time, and the growth rate of bubbles depends on the altitude. It is found that bubbles stop growing early at a small size in two cases: at the altitude below 18,000 ft and when the fluid immediately surrounding the bubble is cleared of supersaturated gas regardless of the fluid composition a few centimeters from the bubble. The findings of the study support the postulate that bubbles must reach a threshold size before symptoms of DCS occur and provide some insight into the mechanics of bubble growth. O.G.

A91-31439* Brandeis Univ., Waltham, MA.

MOTION SICKNESS SUSCEPTIBILITY IN PARABOLIC FLIGHT AND VELOCITY STORAGE ACTIVITY

PAUL DIZIO and JAMES R. LACKNER (Brandeis University, Waltham, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, April 1991, p. 300-307. refs
(Contract NAS9-15147; NAG9-295)
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In parabolic flight experiments, postrotary nystagmus is as found to be differentially suppressed in free fall (G) and in a high gravito-inertial force (1.8 G) background relative to 1 G. In addition, the influence of postrotary head movements on nystagmus suppression was found to be contingent on G-dependency of the velocity storage and dumping mechanisms. Here, susceptibility to motion sickness during head movements in 0 G and 1.8 G was rank-correlated with the following: (1) the decay time constant of the slow phase velocity of postrotary nystagmus under 1 G, no head movement, baseline conditions, (2) the extent of time constant reduction elicited in 0 G and 1.8 G; (3) the extent of time constant reduction elicited by head tilts in 1 G; and (4) changes in the extent of time constants reduction in 0 G and 1.8 G over repeated tests. Susceptibility was significantly correlated with the extent to which a head movement reduced the time constant in 1 G, was weakly correlated with the baseline time constant, but was not correlated with the extent of reduction in 0 G or 1.8 G. This pattern suggests a link between mechanisms evoking symptoms of space motion sickness and the mechanisms of velocity storage and dumping. Experimental means of evaluating this link are described. Author

A91-31440* Pennsylvania State Univ., University Park.

MOTION SICKNESS SEVERITY AND PHYSIOLOGICAL CORRELATES DURING REPEATED EXPOSURES TO A ROTATING OPTOKINETIC DRUM

SENQI HU, WANDA F. GRANT, ROBERT M. STERN, and KENNETH L. KOCH (Pennsylvania State University, University Park and Hershey) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, April 1991, p. 308-314. refs
(Contract NAG9-118)
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Fifty-two subjects were exposed to a rotating optokinetic drum. Ten of these subjects who became motion sick during the first

session completed two additional sessions. Subjects' symptoms of motion sickness, perception of self-motion, electrogastrograms (EGGs), heart rate, mean successive differences of R-R intervals (RRI), and skin conductance were recorded for each session. The results from the first session indicated that the development of motion sickness was accompanied by increased EGG 4-9 cpm activity (gastric tachyarrhythmia), decreased mean successive differences of RRI, increased skin conductance levels, and increased self-motion perception. The results from the subjects who had three repeated sessions showed that 4-9 cpm EGG activity, skin conductance levels, perception of self-motion, and symptoms of motion sickness all increased significantly during the drum rotation period of the first session, but increased significantly less during the following sessions. Mean successive differences of RRI decreased significantly during the drum rotation period for the first session, but decreased significantly less during the following sessions. Results show that the development of motion sickness is accompanied by an increase in gastric tachyarrhythmia, and an increase in sympathetic activity and a decrease in parasympathetic activity, and that adaptation to motion sickness is accompanied by the recovery of autonomic nervous system balance. Author

A91-31441

RELATIONSHIP BETWEEN MANUAL REACTION TIME AND SACCADE LATENCY IN RESPONSE TO VISUAL AND AUDITORY STIMULI

EDWARD J. ENGELKEN, KENNETH W. STEVENS (USAF, School of Aerospace Medicine, Brooks AFB, TX), and JOHN D. ENDERLE (North Dakota State University, Fargo) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, April 1991, p. 315-318. USAF-supported research. refs
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Manual reaction time (RT) responses were analyzed from seven human subjects. Responses were recorded using four kinds of target presentations: fixed visual target, moving visual target, fixed auditory target, and moving auditory target. Moving targets (moving in the horizontal plane) were presented at constant intensity and provided only a motion cue. RTs for the fixed and moving visual targets were 241.5 ms and 233.1 ms, respectively. The 8.4 ms advantage for the moving visual target over the fixed visual target was statistically significant, p less than 0.05. RT for the moving auditory target varied with target movement amplitude and ranged from 219 ms for 40-deg movements to 268 ms for 5-deg movements. For the fixed auditory target in the sagittal plane, average RT was 182.9 ms. Thus, sound-source motion detection was from 36 to 85 ms slower than sound onset detection. The RT results were compared to saccade latency measurements from an earlier study. Both RT and saccade latency showed the same dependency upon target movement amplitude. For small target displacements, saccade latencies for the moving auditory target were longer than for the moving visual target. The longer latencies for the moving auditory target are attributed to the increased processing time required to detect the sound-source motion. Author

A91-31442

MASS DISCRIMINATION UNDER GZ ACCELERATION

JOHN J. DARWOOD (Wright State University, Dayton, OH), DANIEL W. REPPERGER (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH), and CHARLES D. GOODYEAR (Systems Research Laboratories, Inc., Dayton, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, April 1991, p. 319-324. refs
Copyright

The purpose of this study was to assess how the perception of mass discrimination is affected by elevated Gz acceleration. Previous experiments studied mass discrimination under weightless conditions. Ten subjects were tested with the Dynamic Environment Simulator at Wright-Patterson Air Force Base. Masses of 105, 110, 115, 120, and 125 g were compared to a 100-g standard for Delta Ms of 5, 10, 15, 20, and 25 g. The subject had to choose which mass felt heavier. This was done at 1, 2, and 4 Gz. Significant

differences were found between each of the G levels, and the subjects made more errors at higher Gz. Significant differences were also found between each of the Delta Ms, except between Delta Ms of 20 and 25 g. Weber fraction of 0.085, 0.116, and 0.145 were found at 1, 2, and 4 Gz, respectively. Impairment to discrimination was shown by calculating the ratio of the Weber fraction of the elevated Gz to 1 Gz. This demonstrated an impairment to mass discrimination at 1.36 at 2 Gz and 1.71 at 4 Gz. Impairment of mass discrimination under elevated G indicated that loss of adaptation is more important than weight or mass constancy or any other factors which would increase gravitational sensory cues. This study attempted to show adaptation by comparing runs done on different days. To show aftereffect, intervals of 1 G were compared to each other. The study did not find any adaptation or aftereffect. When compared to previous studies done in weightlessness, microgravity was found to be more detrimental to mass discrimination than macrogravity, at least up to 4 Gz. Author

A91-31443**RECOVERY OF CIRCADIAN RHYTHM OF PLASMA CORTISOL LEVELS AFTER A 3-DAY TRIP BETWEEN TOKYO AND SAN FRANCISCO**

NAOKO TAJIMA, MIKIO UEMATSU, ICHIRO ASUKATA, KANHACHIRO YAMAMOTO, MITSUO SASAKI (Japan Airlines, Flight Crew Medical Service Dept., Tokyo) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, April 1991, p. 325-327. refs
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A91-31444**BLOOD PRESSURE RESPONSES TO DIFFERENT ARM POSITIONS DURING VERTICAL HEAD-DOWN ANKLE SUSPENSION**

TOMMY BOONE (Southern Mississippi University, Hattiesburg, MS) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, April 1991, p. 328-330. refs
Copyright

The effects of different arm positions on blood pressure during vertical head-down ankle suspension have been compared. Eighteen subjects have been placed first in the upright sitting position for 4 min, and second in the head-down suspension position for 4 min. A significant increase in brachial artery blood pressure (121/78 mm Hg vs 124/79 mm Hg, respectively), has accompanied head-down suspension in the upright sitting position which may be explained by a variable hydrostatic component. There was a significant decrease in blood pressure to 124/79 mm Hg following the immediate movement of the arms to alongside the body while still suspended. No significant change occurred from upright sitting to full head-down suspension with the arms alongside the body (121/78 mm Hg vs 124/79 mm Hg, respectively). The results indicate a need to standardize the method of blood pressure measurement during head-down suspension. O.G.

A91-31445**CARDIOVASCULAR ADAPTATION DURING SIMULATED MICROGRAVITY - LOWER BODY NEGATIVE PRESSURE TO COUNTER ORTHOSTATIC HYPOTENSION**

ANTONIO GUELL, LAURENT BRAAK (CNES, Toulouse, France), ANNE PAVY LE TRAON (Laboratoire de Medecine Spatiale, Toulouse, France), and CLAUDE GHARIB (Laboratoire de Physiologie de l'Environnement, France) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, April 1991, p. 331-335. Research supported by CNES, Centre Hospitalier Regional de Toulouse, and Fondation pour la Recherche Medicale. refs
(Contract DRET-89-237)
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The study focuses on the effects of periodic lower body negative pressure (LBNP) sessions on cardiovascular adaptation syndrome (CAS) during two bed rest experiments, and specifically on orthostatic hypotension. In the first experiment, three subjects were subjected to several sessions of LBNP per day and two others

were controls; the LBNP group of the first experiment became control in the second experiment and vice versa. Orthostatic investigations were performed in two sessions: 5 days before bed rest and at the end of the 30 day bed rest period. The results demonstrate the following: when the subjects were controls, a high orthostatic hypotension post bed rest with three syncope and one presyncopal state during the first minutes of the tilt test appeared; when the subjects were subjected to LBNP sessions, no orthostatic hypotension was noted. Thus, beneficial effects of the LBNP as a countermeasure against orthostatic hypotension have been demonstrated. O.G.

A91-31448**DECOMPRESSION SICKNESS PRESENTING AS OPTIC NEUROPATHY**

FRANK K. BUTLER (U.S. Navy, Naval Hospital, Pensacola, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, April 1991, p. 346-350. refs
Copyright

The case of decompression sickness (DCS) presented as an acute optic nerve dysfunction seen after repetitive hypobaric exposures is described. DCS is defined as a systemic disorder caused by an abrupt decrease in the ambient atmospheric pressure. A male parachutist developed optic neuropathy after a series of multiple repeated hypobaric exposures. Recompression and hyperbaric oxygen therapy is recommended for treatment of DCS. O.G.

A91-31496#**EFFECTS OF CHLORPHENIRAMINE ON SACCADIC EYE MOVEMENTS**

ASAO KOBAYASHI, ATSUSHI KADOO, and ZOJIRO KATOH Japan Air Self Defense Force, Aeromedical Laboratory, Reports (ISSN 0023-2858), vol. 30, Dec. 1989, p. 107-115. In Japanese, with abstract in English. refs

The effects of chlorpheniramine on saccadic eye movements were studied in three healthy adult male volunteers. In two separate experiments, 10 mg chlorpheniramine maleate and placebos were given, and eye movement recordings were made before and at 1, 2, 3, 4, 5, and 24 hours after oral administration. Peak and mean saccadic velocity of horizontal eye movements were measured electrooculographically. Plasma concentrations of chlorpheniramine were measured at the same time. Chlorpheniramine produced a significant impairment of peak and mean saccadic velocity. Time to achieve maximum effect was 2-4 hours after administration. There was linear correlation between plasma chlorpheniramine concentration and change of saccadic velocity. Author

A91-31497#**A CASE OF SERIOUS ARRHYTHMIA DURING ANTI-G TRAINING**

TOMOMITSU AKAMATSU (Defense Agency, Air Staff Office, Japan), SHOICHI TACHIBANA, and AKIO NAKAMURA Japan Air Self Defense Force, Aeromedical Laboratory, Reports (ISSN 0023-2858), vol. 30, Dec. 1989, p. 117-123. In Japanese, with abstract in English. refs

The Japanese Air Self-Defense Force has experienced a large number of high-G centrifuge testing-related ECG abnormalities: ventricular premature contractions were the most frequent abnormalities, and found in 40 percent of centrifuge trainees, while supraventricular premature contractions were found in 20 percent of trainees. Attention is given to a healthy subject who developed concurrent arrhythmias with blurred consciousness. Further cardiovascular examinations showed no abnormality. The possibility of excessive vagal tone during deceleration as a cause of this behavior is considered. O.C.

A91-31498#**STUDY OF THE WHOLE-BODY RESPONSE TO VIBRATION. I - THE EFFECT OF REPEATED EXPOSURE TO THE LONG-TERM WHOLE-BODY VIBRATION**

AKIRA ARAI (Tokyo, Waterworks Bureau, Japan), AKIHIKO ONOZAWA, and YOSHIHIRO IWATA Japan Air Self Defense

Force, Aeromedical Laboratory, Reports (ISSN 0023-2858), vol. 31, June 1990, p. 1-16. In Japanese, with abstract in English. refs

Results are presented of an experiment in which rats were exposed to + or - 1.0 Gx, 20 Hz sinusoidal vibration with varying durations for three hr/day, six days/wk, for a period of twelve weeks. Blood biochemical changes were analyzed in order to examine the degrees of tissue damage during prolonged exposure to the whole-body vibration. The main results of the blood chemistry changes are outlined. The experimental results indicate that repeated exposure to long-term whole-body vibration produces heart- and lung-tissue damage in the early stages of the exposure. In the later stages of the exposure, liver damage and damage of the skeletal muscles occur. S.A.V.

A91-32376

THE CONDITION OF MICROCIRCULATION IN FLIGHT PERSONNEL DEPENDING ON THE AGE AND THE PRESENCE OF CARDIOVASCULAR DISORDERS [SOSTOIANIE MIKROTSIRKULIATSII U LITS LETNOGO SOSTAVA V ZAVISIMOSTI OT VOZRASTA I NEKOTORYKH ZABOLEVANI SERDECHNO-SOSUDISTOI SISTEMY]

O. K. VEKLICH and E. G. MUKHAMEDOV Voennno-Meditsinskii Zhurnal (ISSN 0026-9050), Dec. 1990, p. 46-48. In Russian. refs Copyright

The use of conjunctival biomicroscopy in evaluating the condition of microcirculation was investigated in 105 subjects. Of these, 56 subjects were healthy, 16 were affected by atherosclerosis of aorta and cardiac veins without showing symptoms of coronary insufficiency, 21 had a latent form of chronic ischemic disease, and 12 had symptoms of first-stage hypertension. It was shown that the conjunctival biomicroscopy method could identify the pathology of conjunctival microvessels at the early stages of cardiovascular disorders and could differentiate between ischemic heart disease, atherosclerosis, and hypertension. It is noted that healthy subjects may display changes in venous microcirculation and that, in subjects at least 40 years old, there often occurred signs of erythrocyte aggregation in individual venules. I.S.

A91-32377

CHARACTERISTICS OF CALCIUM AND PHOSPHORUS METABOLISM UNDER CONDITIONS WHEN THE ENVIRONMENT IS CHANGED [OSOBENNOSTI OBMENA KAL'TSIIA I FOSFORA V ORGANIZME V USLOVIAKH IZMENENNOI SREDY OBITANIIA]

M. A. GREBENIK, A. A. MAKHNENKO, A. A. SHAPOVALOV, V. I. POPOV, and S. T. SERGEEV Voennno-Meditsinskii Zhurnal (ISSN 0026-9050), Dec. 1990, p. 48-52. In Russian. Copyright

The effects of hypokinesia, insufficient UV irradiation, and the composition of inhaled gas on the characteristics of calcium and phosphorus metabolism of humans subjected to four months of residence in hermetically sealed quarters were investigated. Subjects were divided into three groups: (1) subjects who performed physical exercises and were daily subjected to UV irradiation at 0.15 'minimal erythema dose' (MED); (2) subjects who did not exercise and who received no UV irradiation; and (3) subjects who did not exercise but who received a daily UV dose of 0.05 MED. The composition of oxygen in the gas mixture varied from 21.3 to 26.3 kPa, while the CO₂ composition varied from 0.1 to 0.4 kPa. It was found that the parameters of Ca and P metabolism were negatively affected by all three factors (hypokinesia, insufficient UV, and the deviations from the atmospheric contents of O₂ and CO₂). I.S.

A91-32384

BAROREFLECTORY REGULATION OF BLOOD FLOW IN THE HUMAN BODY DURING TRANSITION TO WEIGHTLESSNESS (SIMULATION MODELING) [BAROREFLEKTORNAIA REGULIATSIIA KROVOOBRAZHENIIA CHELOVEKA PRI PEREKHODE V SOSTOIANIE NEVESIMOSTI /IMITSIONNOE MODELIROVANIE/]

B. L. PALETS and L. D. PALETS (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 86, 1990, p. 53-56. In Russian. refs Copyright

This paper presents a simulation model of blood flow in the human body, which describes the hemodynamics in the branched cardiovascular system and baroreflectory regulation by the aortal and the sinocarotid reflexes and by the Bainbridge and the Kitaev reflexes. The model is used to simulate reactions to a rapid transition of the human body from the vertical position to the state of weightlessness. The model responses are shown to agree qualitatively with observations of human subjects during immersion. It is shown that the increase of the central blood volume and of the cardiac prestress in these conditions is significantly affected by arterial baroreflexes, causing a significant depression of cardiac pumping activity. I.S.

A91-32385

MODELING OF INTERACTIONS BETWEEN MOTOR REFLEXES OF THE HIGH- AND LOW-BLOOD-PRESSURE ZONES [MODELIROVANIE VZAIMODEISTVIA MEKHANOREFLEKSOV ZON VYSOKOGO I NIZKOGO DAVLENIIA KROVI]

R. D. GRIGORIAN (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 86, 1990, p. 92-96. In Russian. refs Copyright

This paper proposes a mathematical model for the regulation of human hemodynamics by mechanoreceptors in the zones of low blood pressure (i.e., the vena cava mouth and lung arteries) and high blood pressure (aortal arch, carotid sinuses, and brain arteries). The behavior of the model during simulation of short-term weightlessness is analyzed. Special attention is given to the possible mechanisms responsible for hemodynamic changes observed in humans subjected to weightlessness. I.S.

N91-19031*# Ohio Univ., Athens.

ANALYZING THOUGHT-RELATED ELECTROENCEPHALOGRAPHIC DATA USING NONLINEAR TECHNIQUES

TRENT SKIDMORE In NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1989-1990 p 91-95 Dec. 1990

Avail: NTIS HC/MF A09 CSCL 06P

A unique method is presented for collecting, studying and interpreting thought-related electroencephalogram (EEG) data. The use of a chaos based nonlinear analysis technique is shown to be promising in providing insight into relating conscious thought to specific EEG data. A discussion of the practical limitations of this technique is also included. Author

N91-19568# Joint Publications Research Service, Arlington, VA. REACTIVITY OF EXHAUSTED HUMAN SKELETAL MUSCLE FIBERS FOLLOWING PROLONGED ANTIORTHOSTATIC HYPOKINESIA Abstract Only

S. L. KUZNETSOV and V. V. STEPANTSOV In its JPRS Report: Science and Technology. USSR: Life Sciences p 1 4 Jan. 1991 Transl. into ENGLISH from Arkhiv Anatomii, Gistologii i Embriologii (Leningrad, USSR), v. 97, no. 7, Jul. 1989 p 53-59

Avail: NTIS HC/MF A03

Ultrastructural and histochemical studies were conducted on skeletal muscle biopsies obtained from eight men subjected to antiorthostatic hypokinesia for 360 days, with and without exercise while in the orthostatic position. The data demonstrated that after 120 days at a 6 degree antiorthostatic incline, there was extensive damage to the contractile and energetic element of the skeletal muscle fibers. Disorganization and destruction was seen to begin with the M-line and then to encompass the entire space between adjacent Z-lines. The Z-lines were unaffected, with the number of affected sarcomeres increasing with time. After 360 days, atrophic changes were particularly severe in the case of type I fibers. Metabolic deterioration was evident in diminished total protein and glycogen levels. Various forms of physical training in the antiorthostatic position were found to diminish the extent and

progression of atrophy. The beneficial effects of physical exercise were directly proportional to the intensity of exercise and an early start of the exercise program. The relative stability of the cytoskeleton in the face of myosin and actin breakdown may explain the potential of the myofibrils for recovery. Author

N91-19569# Joint Publications Research Service, Arlington, VA.
GRAVITATION RECEPTOR REACTION IN RESPONSE TO EFFECT OF ACCELERATION Abstract Only

A. T. PAKUNOV *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 26 4 Jan. 1991 Transl. into ENGLISH from Zhurnal Ushnykh, Nosovykh i Gorlovykh Boleznay (Kiev, USSR), no. 2, Mar. - Apr. 1990 p 8-13

Avail: NTIS HC/MF A03

A further study of gravitation receptor reaction involved reproduction of gravitational overloading with the use of a centrifuge with radius of rotation of 100 cm and 95 revolutions per minute. The force of centrifugal acceleration was 10.05 g and the duration of effect was 5 minutes. Experiments on 6 guinea pigs and 4 rabbits exposed to this acceleration showed a pronounced increase in gravitation reaction. All experimental animals remained motionless for the first 5 minutes after the end of the effect acceleration. Experiments on 6 guinea pigs and 4 rabbits exposed to this acceleration showed a pronounced increase in gravitation reaction. All experimental animals remained motionless for the first 5 minutes after the end of the effect of acceleration. Marked disturbance of coordination of movement was noted for at least 1 hour. Electron microscopic study of the gravity receptor (utricle) revealed rather pronounced disturbances in many structures: bulging of some of the pillar cells cytoplasm into the endolymphatic space, surrounding of cynocilia by cytoplasmic matrix, cytoplasm vacuolization, decrease of cell nuclei electron density and pronounced dilation and clarification of calicous nerve terminals. The presence around the cynocilia of a matrix resembling cytoplasm from the pillar cells prevents intense excitation of the receptors. It is possible that, after a 10-minute overload, the advantage of bulging of some of the cytoplasm from the pillar cells involves limitation of mobility of the cynocilia surrounded by the cytoplasmic matrix. Author

N91-19570# Joint Publications Research Service, Arlington, VA.
EFFECTS OF HYPERBARIC OXYGENATION ON CENTRAL HEMODYNAMICS AND OXYGEN CONSUMPTION IN SEVERE PHYSICAL TRAUMA Abstract Only

A. G. MAGOMEDOV *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 26 4 Jan. 1991 Transl. into ENGLISH from Patologicheskaya Fiziologiya i Eksperimentalnaya Terapiya (Moscow, USSR), no. 2, Mar. - Apr. 1990 p 26-28

Avail: NTIS HC/MF A03

Therapeutic trials were conducted with hyperbaric oxygenation on outbred, 12-18 kg dogs subjected to a gunshot wound with skeletal damage. The animals were divided into groups on the basis of treatment and subjected to central hemodynamic and ventilatory monitoring in conjunction with assessment of clinical chemistries. In general, severe trauma complicated by 20-25 percent hypovolemia led to 100 percent mortality of untreated dogs within 1 hr 25 min to 3 hr of the onset of shock. Animals managed in the conventional manner presented with a 29.4 percent survival rate. Finally, animals managed with hyperbaric oxygenation (1-2 atm pressure for 50 min; 4-5 sessions, for 3 days) in combination with conventional medical and surgical management had a survival rate of 76.2 percent. Hyperbaric oxygenation-managed dogs showed a rise in circulating blood volumes, cardia index and VO₂, facilitating correction of all forms of oxygen deficiency. Author

N91-19571# Joint Publications Research Service, Arlington, VA.
EFFECTS OF HIGH TEMPERATURE AND HUMIDITY ON MENTAL STATE AND METABOLISM Abstract Only

A. S. SHANAZAROV, V. P. MAKHNOVSKIY, and E. I. KUZUYTA *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 27-28 4 Jan. 1991 Transl. into ENGLISH from Fiziologiya

Cheloveka (Moscow, USSR), v. 15, no. 4, Jul. - Aug. 1989 p 92-96

Avail: NTIS HC/MF A03

The effects of a combination of high temperature and humidity on mental state and metabolism were studied in a group of 20 men, 18-20 years old. The studies were conducted in a chamber adjusted to 50 C and a relative humidity of 80 percent, with an average maximum exposure of 20.2 minutes. Neuropsychologic testing revealed that as a result of such exposure, indicators of logical thinking decreased by 54.6-64 percent, and attentiveness indicators, by an average of 32.1 percent. Concomitantly, metabolic studies demonstrated activation of sympathetic mechanisms: urinary epinephrine rose by 68.9 percent and norepinephrine by 151.4 percent. Other data indicated activation of lipid peroxidation by 55.1 percent and elevation of unconjugated bilirubin in the blood by 54.8 percent. These observations demonstrated that a combination of high temperature and humidity exerts an adverse effect on mental faculties. The latter may be related to elevation of unconjugated bilirubin in the blood which transgresses the blood-brain barrier and may lead to uncoupling of oxidative phosphorylation in brain mitochondria. Author

N91-19573# Karolinska Inst., Stockholm (Sweden).
 Environmental Physiology Lab.

EFFECTS OF SHORT-LASTING WEIGHTLESSNESS ON GAS EXCHANGE DURING LIGHT EXERCISE

DAD LINNARSSON, PIETRO E. DIPRAMPERO, JUERGEN P. STEGEMANN, CARL J. SUNDBERG, UWE HOFFMANN, and DIETER ESSFELD (Deutsche Sporthochschule, Cologne, Germany, F.R.G.) *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 9-11 Nov. 1990 Sponsored by Swedish Space Board; CNR; BMFT; and ESA

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Gas exchange during exercise was studied during short lasting microgravity in parabolic flight. Oxygen uptake at the mouth showed wide fluctuations, with an increase during the 20 to 25 sec period of microgravity and a depression compared to control during the high G phase following immediately after the micro G period. Estimates of the pulmonary and peripheral time courses of oxygen exchanges suggest that peripheral oxygen cost of light exercise does not differ from that of normal G and that the observed oxygen uptake changes at the mouth are caused by G induced changes in the oxygen stores and the blood flow in the lungs.

ESA

N91-19574# Vrije Univ., Brussels (Belgium). Inst. of Interdisciplinary Research.

LUNG VOLUMES, CHEST WALL CONFIGURATION, AND PATTERN OF BREATHING IN MICROGRAVITY

MANUEL PAIVA, M. ESTENNE, and L. A. ENGEL (Westmead Hospital, Sydney, Australia) *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 13-15 Nov. 1990

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Changes in lung volume and chest wall configuration in five seated subjects was measured during the 5th ESA campaign of parabolic flights. The main results are summarized and an overview of the articles published in the open literature are presented. A consistent relationship between end expiratory lung volume measured by flow integration, the volumetric displacements of the two chest wall compartments (V_{sum}) and G_z was found in seated subjects, both volumes increasing with increase in G_z and decreasing during periods of microgravity. The volume changes were almost entirely the result of a change in the abdominal compartment. The abdominal contribution to the tidal volume increased substantially under conditions of microgravity and decreased slightly when gravitational forces nearly doubled. Despite the changes in V_{sum} and configuration, the temporal pattern of breathing appeared to be uninfluenced by the changes in gravity.

ESA

N91-19575# Amsterdam Univ. (Netherlands). Dept. of Physiology.

BLOOD PRESSURE REGULATION IN PARABOLIC FLIGHT

JOHN M. KAREMAKER, J. J. SETTELS (Organization for Health Research, TNO, Amsterdam, Netherlands), H. J. P. KUYKENS, and K. H. WESSELING *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 17-18 Nov. 1990 (Contract SRON-MG020-1988)

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The cardiovascular effects of sudden microgravity lasting 25 seconds in parabolic flight in eight test subjects, at rest, sitting upright during three parabolas was measured. The continuous, non invasive finger blood pressure measurements by Finapres (TM) was used. By means of hydrostatic height compensation blood pressure was referred to heart level. Both the responses to the pull up and pull out phase of the aircraft trajectory and to the period of actual microgravity seem to be dominated by the altered hydrostatic conditions at the baroreceptors. In the pull up, blood pressure and heart rate increases were followed, when the phase of microgravity was entered, by a rapid decrease of heart rate, decreasing blood pressure and increased stroke volume. By the end of the microgravity this had changed to a situation where heart rate and cardiac output had returned to control levels, but blood pressure was still decreased. The general outline of the response is comparable to what is observed when a person is passively tilted from upright to supine. ESA

N91-19576# Institute of Biomedical Problems, Moscow (USSR). **MEDICAL RESULTS OF THE FOURTH PRIME EXPEDITION ON THE ORBITAL STATION MIR**

A. I. GRIGORIEV, V. V. POLIAKOV, V. V. BOGOMOLOV, A. D. EGOROV, I. D. PESTOV, and I. B. KOZLOVSKAYA *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 19-22 Nov. 1990

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The medical objectives of the fourth prime expedition on the orbital station MIR were to monitor the cabin environmental parameters, to control prophylactic measures, and to implement the program of medical investigations. Participation of a trained physician helped to increase the reliability of medical support and to enlarge the scope of medical experiments in flight. The health condition and work capacity of the cosmonauts at different flight stages and after recovery remained satisfactory. Functional changes were adequate to the exposure and reflected both the general pattern of adaptative changes and the specific features of individual crew members. ESA

N91-19577# Hopital Bretonneau, Tours (France). Inst. National de la Sante et de la Recherche Medicale.

ULTRASOUND INVESTIGATION OF THE CARDIOVASCULAR SYSTEM DURING THE 25 DAYS FRENCH-SOVIET SPACEFLIGHT (26 NOVEMBER - 21 DECEMBER 1988)

PHILIPPE ARBEILLE, O. ATKOV, V. V. BYSTROV, J. L. CHRETIEN, GALINA FOMINA, V. GRATCHOV, N. KOKOVA, F. PATAT, V. V. POLIAKOV (Institute of Biomedical Problems, Moscow, USSR), J. M. POTTIER et al. *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 23-26 Nov. 1990 Sponsored by CNES

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The main hemodynamic parameters of the left heart function and of the peripheral arterial system (cerebral, renal, femoral arteries) were measured six times during the flight (flight day 4, 5, 15, 18, 20, 24) and 5 times post flight (day + 1 +3 +7 +15 +30). The venous return was also explored at the level of the jugular, femoral, and hepatic veins. Most of the hemodynamic changes: the reduction of the cardiac chambers volume, the increase of the heart rate and the acceleration of the venous return, are in favor of a hypovolemia which triggers a decrease of the vascular resistance in the main vascular areas such as the brain or the kidney. The experiment showed that the venous system

is strongly disturbed and does not recover during the flight. The results confirm that the vascular disadaptation develops promptly in absence of countermeasure and suggest that the ultrasound methods will be of great interest for the follow up of the vascular deconditioning and the evaluation of the efficiency of the countermeasures already used during long term flights. ESA

N91-19578# Institute of Biomedical Problems, Moscow (USSR). **ULTRASOUND INVESTIGATION OF THE CARDIOVASCULAR SYSTEM DURING THE 25-DAYS SOVIET-FRENCH FLIGHT: CARDIAC ASPECTS**

GALINA FOMINA, N. KOKOVA, V. V. BYSTROV, V. V. POLIAKOV, L. STROGONOVA, V. GRATCHEV, O. ATKOV, J. M. POTTIER, PHILIPPE ARBEILLE, F. PATAT (Hopital Bretonneau, Tours, France) et al. *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 27-29 Nov. 1990

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Cardiovascular changes induced by weightlessness were assessed by ultrasound echography and doppler using the As de coeur device. During the flight the left atrium and ventricle volumes were decreased. Despite the reduction of the stroke volume, the cardiac output was slightly elevated due to an increase in heart rate. The cardiac contractility was not affected at any moment. The pulmonary pressure index does not show any significant change. The systemic vascular resistance was decreased. Most of the hemodynamic changes were believed to be due to a hypovolemia. ESA

N91-19579# Amsterdam Univ. (Netherlands).

VESTIBULAR FUNCTION IN ALTERED STATES OF GRAVITY

WILHELMUS J. OOSTERVELD, H. A. A. DEJONG, and HENDRIKA W. KORTSCHOT *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 31-36 Nov. 1990

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During parabolic flight the caloric test was conducted in human subjects. The horizontal nystagmus disappears in microgravity, after an exponential slow phase velocity decay, that shows a specific time constant. A vertical nystagmus is seen. Both the horizontal and the vertical component are gravity dependent. The vertical component is not directly related to the choice of temperature as well as to the side of the chosen ear. Frequently a reverse directed horizontal nystagmus, a secondary nystagmus, appears in caloric tests, conducted in parabolic flight. The results support Barany's convection theory. It is also clear that the origin of the caloric nystagmus cannot only be explained by Barany's theory. ESA

N91-19580# Mainz Univ. (Germany, F.R.). Dept. of Physiology. **OCULAR ROLL UNDER CHANGING Z-AXIS ACCELERATION AND NECK POSITION**

JOACHIM WETZIG, K. HOFSTETTER, M. REISER, and R. VONBAUMGARTEN *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 37-42 Nov. 1990 (Contract BMFT-01-QV-223-9)

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Ocular Counter Rolling (OCR) was measured in four unmedicated subjects under conditions of parabolic flight. A medium size aircraft (Caravelle) performed 30 single parabolas a day, of 20 to 25 seconds duration, spaced two to four minutes apart. This resulted in alternating phases of normal, hyper, hypo and again hyper gravity. Subjects sat yoga fashion upright facing towards the aircraft cockpit. During each pullup, low G phase, and pullout of the parabolas, the left eye was briefly illuminated to record the eyeball rotary position. OCR was enhanced by increase in gravitoinertial force. It decreased, when near weightlessness set in. Upon resumption of hypergravity a complete return to preweightlessness values was observed in two of four subjects, while the other two subjects were incomplete in recovery. Pure neck receptor stimulation did not yield a consistent major OCR reaction. ESA

N91-19581# Provence Univ., Marseille (France). Lab. de Neurobiologie Humaine.

BODY PROPRIOCEPTIVE REFERENCES IN WEIGHTLESSNESS AS STUDIED BY MUSCLE TENDON VIBRATION

J. P. ROLL, K. E. POPOV, VICTOR S. GURFINKEL, M. I. LIPSCHITS, CLAUDIE ANDRE-DESHAYS (Centre National de la Recherche Scientifique, Paris, France), J. C. GILHODES, and CYNTHIA QUONIAM /In ESA, Fourth European Symposium on Life Sciences Research in Space p 43-48 Nov. 1990 (Contract CNES-500193; CNES-500243)
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The hypothesis that the modifications of both biomechanical and psychological conditions occurring under microgravity involve considerable reorganization of body perception and postural control was investigated. The proprioceptive information originating in various muscles is known to contribute, together with visual, vestibular and sole cutaneous information to postural regulation. The proprioceptive channel was specifically activated by muscle vibration which is able to elicit both illusory movement sensations and postural responses. Data show that the major functional reorganization of the proprioceptive information processing occurs in microgravity, affecting both perceptual and motor aspects of behavior. It is possible that these proprioceptive adaptations may be partly attributable to the new whole body propulsive foot functions imposed by long term exposure to weightlessness and to the adaptation of motor behavior to the third dimension of space. The results might therefore not so much reflect a major change in the spindle proprioceptive receptor function but rather indicate a more central sensorimotor rearrangement organized by the central nervous system. ESA

N91-19583# Udine Univ. (Italy). Inst. of Biology.
PEDALLING IN SPACE TO SIMULATE GRAVITY: THE TWIN-BIKE SYSTEM

GIULIOANDREA ANTONUTTO, CARLO CAPELLI, and PIETRO E. DIPRAMPERO /In ESA, Fourth European Symposium on Life Sciences Research in Space p 59-62 Nov. 1990
Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

Microgravity leads to progressive musculoskeletal decay. This results in a significant decrease of the exercise capacity and in orthostatic intolerance, this last manifesting itself upon the return to Earth. Thus, without appropriate countermeasures, long term manned space flights may be seriously jeopardized. A simple mechanical system that may partially obviate the above problems is proposed. The system consists of two mechanically coupled bicycles riding along the inner wall of a cylindrical space module. The bikes' motion induces a force which stimulates gravity on the exercising subjects. The biomechanical and bioenergetical aspects of such a system are discussed. It is concluded that by appropriately selecting the radial dimensions of this last in order to minimize vestibular disturbances, head to feet acceleration gradients and manufacturing costs, it may be possible to combine exercise and simulated gravity, with no need for additional external power. ESA

N91-19584# Technische Univ., Vienna (Austria). Dept. of Sports and Exercise Physiology.

ISOKINETIC FORCE VELOCITY AND ELECTROMYOGRAPHIC CHARACTERISTIC OF KNEE AND ELBOW EXTENSOR AND FLEXOR MUSCLES IN THE 0-G ENVIRONMENT

NORBERT BACHL, R. BARON, MASSUD MOSSAHEB, W. BUMBA, and R. ALBRECHT (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) /In ESA, Fourth European Symposium on Life Sciences Research in Space p 63-68 Nov. 1990
Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

Electromyographic and force velocity response of knee and elbow extensor and flexor muscles during isokinetic concentric and eccentric work between 1g and 0g environment are compared.

A special ergometric dynamometric device which will be flown on the Russian Space Station MIR in the framework of the Austrian Russian space program was constructed. This constant velocity ergometer makes it possible to perform exercise of either the arm or leg muscles while making translatory movements within a definable angular range, both parallel and diagonal in the sagittal plane. Both acyclic and cyclic concentric and eccentric movements are possible with following characteristics to be adjusted: joint angle, angular velocity, contraction frequency and contraction/decontraction ratio per cycle. Force velocity relationship is measured in real time mode using a strain gauge system with angle positioner. In addition an electromyogram is recorded, integrated and analyzed in relation to the force velocity characteristics. Starting with ground based ergometric and dynamometric tests hard and software development for data acquisition and analysis is described. Some data from ground based experiments are demonstrated to show the differentiated behavior in activation and force velocity characteristics of the working muscles. ESA

N91-19585# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Inst. for Aerospace Medicine.

MEDEX: A USEFUL TOOL FOR COUNTERACTING ORTHOSTATIC INTOLERANCE RESULTING FROM BODY FLUID LOSS UNDER MICROGRAVITY

FRIEDHELM BAISCH and WOLFGANG BANGERT (Panares, Munich, Germany, F.R.) /In ESA, Fourth European Symposium on Life Sciences Research in Space p 69-71 Nov. 1990
Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

Dehydration with decreased blood volume due to a microgravity environment is believed to play a decisive role in the etiology of orthostatic intolerance. Increase of body fluid content before landing, especially in the intravascular space, may counteract the symptoms. Long term effects of both a cumulative Lower Body Negative Pressure (LBNP) load and an intravenous infusion of saline during dehydration caused by Head Down Tilted (HDT) bedrest is studied. Intravenous infusion of isotonic saline causes a transient increase in central blood volume and cardiac filling but the long term effect observed during an HDT study is an opposite one with a loss of body fluids. The long term effect of a stressful LBNP stands in contrast to the long term effect of intravenous saline infusion. The cause for the changes in body water content is most likely a change in the relative distribution of plasma protein between the intravascular and interstitial compartments. Different time constants of the mechanisms that regulate water and electrolyte on the one side and lymph formation and flow on the other side lead to the long term effects of these interventions. ESA

N91-19586# Deutsche Sporthochschule, Cologne (Germany, F.R.). Physiologisches Inst.

TIME COURSES OF ENDURANCE PERFORMANCE PARAMETERS FOLLOWING 500 ML BLOOD WITHDRAWAL

KLAUS BAUM, UWE HOFFMANN, DIETER ESSFELD, and JUERGEN P. STEGEMANN /In ESA, Fourth European Symposium on Life Sciences Research in Space p 73-76 Nov. 1990 (Contract BMFT-01-QV-87354)
Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

Before and after a 500 ml reduction in blood volume 14 healthy subjects (7 male, 7 female, 20 to 30 years) took part in a series of bicycle ergometer tests in upright body position. Tests were performed 1 week before, 2 hours after volume reduction (no fluid or food intake prior to this test), and 1, 2, 4, 6 and 8 weeks later. Each test consisted of 17 min randomized switchings between 20 W and 80 W for the determination of oxygen uptake kinetics (Pseudo Random Binary Sequence (PRBS) technique) and subsequent step increases (50 W, 4 min per stage) for the determination of maximum oxygen uptake, the heart rate oxygen uptake relationship and blood lactate concentrations. Maximum

oxygen uptake was significantly reduced immediately after blood withdrawal, while oxygen uptake kinetics were essentially identical in all tests. ESA

N91-19587# Karolinska Inst., Stockholm (Sweden). Environmental Physiology Lab.

OXYGEN UPTAKE DURING CONCENTRIC AND ECCENTRIC RESISTIVE EXERCISE USING A NEW GRAVITY-INDEPENDENT ERGOMETER

HANS E. BERG and PER A. TESCH /In ESA, Fourth European Symposium on Life Sciences Research in Space p 77 Nov. 1990

Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

An ergometer for strength training of postural muscle groups in microgravity was evaluated. The gravity independent non electrical device examined is designed for heavy resistive exercise of the lower limbs. Oxygen uptake ranged 1.1 to 2.1 l/minutes during exercise, while forces exerted ranged 1365 to 1600 Newtons. Oxygen cost and muscular loading were of the same magnitude as previously reported for heavy resistance exercise using conventional exercise equipment. It is concluded that concentric eccentric heavy resistance training using large postural muscle groups can be performed at a low oxygen cost using the gravity independent ergometer examined. ESA

N91-19588# Innsbruck Univ. (Austria). Klinik fuer Neurologie. **COORDINATION OF EYE, HEAD AND ARM MOVEMENTS IN WEIGHTLESSNESS**

MEINHARD BERGER, F. GERSTENBRAND, MIKLOS MAROSI, E. KARAMAT, ARMIN MUIGG, T. MELICHAR, R. SCHAUER, I. B. KOZLOVSKAYA, A. SOKOLOV, and M. BELAEVA (Institute of Biomedical Problems, Moscow, USSR) /In ESA, Fourth European Symposium on Life Sciences Research in Space p 79-81 Nov. 1990

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The experiment MONIMIR will be part of the investigation program of the Austrian Soviet spaceflight AUSTROMIR in November 1991. In this experiment the coordination and adaptation of the eye, head and arm movement in microgravity will be investigated. The following tests will take place: preprogrammed movements on acoustic and visual targets; tracking movements on visual targets; memory movements; influence of neck reflexes on arm movements; biomechanics of the cervical spine; T-reflex (patellar reflex). The methods and equipment to be used are briefly described. ESA

N91-19589# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

LIFE SCIENCES IN ESA TRP ACTIVITY

NORA BOUGHAROUAT, J. KINGDON, PETER SCHILLER, and FRANCOIS BRECHIGNAC /In its Fourth European Symposium on Life Sciences Research in Space p 83-87 Nov. 1990

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ESA is supporting a Technological Research Program (TRP) in order to investigate and prepare technologies for future space missions requirements. This TRP program covers nine majors themes. Theme 5 represents microgravity utilization, itself concerned with development in support of six main areas. The poster is concentrating on the three areas representing life sciences activities: space medicine, space biology and applied space biology. Their previous developments, present developments and future developments are briefly presented. ESA

N91-19590# Trondheim Univ. (Norway). Dept. of Biomedical Engineering.

VASCULAR GAS BUBBLES OR DECOMPRESSION SICKNESS: WHAT IS THE PROPER ENDPOINT FOR EVALUATING DECOMPRESSION PROCEDURES

ALF O. BRUBAKK /In ESA, Fourth European Symposium on Life

Sciences Research in Space p 89-92 Nov. 1990

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Decompression leads to gas bubble formation in the cardiovascular system to a certain degree in all individuals. The degree of gas bubble formation as well as decompression sickness is not only dependent upon the degree of supersaturation, but on many physiological factors. Changes can occur in several organs, most notably in the central nervous system in the absence of clinical signs of decompression sickness. It is argued that the degree of vascular bubble formation should be used to evaluate decompression procedures. This gas bubble monitoring will lead to reduced health hazards and an increased understanding of the decompression process. ESA

N91-19591# Freie Univ., Berlin (Germany, F.R.). Dept. of Otorhinolaryngology.

MEASUREMENT OF EYE MOVEMENTS IN SPACE-RELATED RESEARCH ENVIRONMENTS

ANDREW H. CLARKE, WINFRIED TEIWES, and H. SCHERER /In ESA, Fourth European Symposium on Life Sciences Research in Space p 93-94 Nov. 1990

(Contract BMFT-01-QV-8802)

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A primary function of the vestibular system is the stabilization of the visual image during head movements; this is facilitated by the elicitation of compensatory eye movements via the Vestibulo Ocular Reflex (VOR). In consequence, evaluation of reflex eye movements has become essential for both the scientific study and clinical diagnosis of the vestibular system. In space oriented research, eye movement evaluation thus enables the investigation of those changes in the vestibular system concomitant with alterations in the gravito-inertial environment. Videoculography represents a flexible, noninvasive instrument for measurement of eye movements in all three orthogonal planes. In particular, the technique should enable comprehensive study of ocular torsion as an indicator of otolith function. The technique is outlined and initial results from a parabolic flight study designed to investigate those components of eye movement elicited by the otolith ocular response are presented. ESA

N91-19592# Technische Univ., Munich (Germany, F.R.). Medizinische Klinik.

PHYSIOLOGY OF BODY WATER AND SALT REGULATION.

PART 1: CIRCADIAN RHYTHMS OF ENDOCRINE SYSTEMS AND URINARY ELECTROLYTE EXCRETION IN HUMANS

CHRISTIAN DRUMMER, M. HEER, B. MOLZ, MATTHIAS SCHLOSSBERGER, CARSTEN STADEAGER, LOTHAR ROECKER, PETER NORSK, FELICE STROLLO, FRIEDHELM BAISCH, JORGEN WARBERG (Danish Aerospace Medical Center of Research, Copenhagen.) et al. /In ESA, Fourth European Symposium on Life Sciences Research in Space p 95-98 Nov. 1990 Sponsored by BMFT, and ESA

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In a ground based study, the circadian rhythms in urinary excretion of water and electrolytes and the circadian variations in plasma levels of hormones which participate in body fluid homeostasis, were investigated. Six healthy volunteers spent 9 days in a recumbent body position under strictly controlled conditions. The urinary excretion of water and electrolytes as well as plasma levels of vasopressin, aldosterone, renin, cortisol, epinephrine and cyclic GMP showed striking circadian rhythms. No circadian variability was observed for plasma levels of norepinephrine and atrial natriuretic peptide. ESA

N91-19593# Technische Univ., Munich (Germany, F.R.). Medizinische Klinik.

PHYSIOLOGY OF BODY WATER AND SALT REGULATION.

PART 2: VOLUME AND ELECTROLYTE HOMEOSTASIS AFTER AN ACUTE SALINE INFUSION

CHRISTIAN DRUMMER, M. HEER, B. MOLZ, MATTHIAS

SCHLOSSBERGER, CARSTEN STADEAGER, LOTHAR ROECKER, PETER NORSK, FELICE STROLLO, JERGEN WARBERG, NIELS JUEL CHRISTENSEN (Danish Aerospace Medical Center of Research, Copenhagen.) et al. /In ESA, Fourth European Symposium on Life Sciences Research in Space p 99-102 Nov. 1990 Sponsored by BMFT, and ESA Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

Six healthy male volunteers were investigated under strictly controlled conditions to determine the renal and hormonal responses to an acute isotonic saline infusion. During a nine day study in recumbent body position, the volunteers received an infusion of about two liters within 25 minutes. For comparison, a control experiment without infusion was conducted. The urinary excretion of water, sodium, potassium and chloride increased for about two days following the infusion. Water and sodium balance was not achieved until 40 hours post infusion. The renin aldosterone system and plasma catecholamine concentrations were in parallel reduced for about two days. Only small alterations were observed in plasma vasopressin, cortisol and atrial natriuretic peptide levels. ESA

N91-19594# Deutsche Sporthochschule, Cologne (Germany, F.R.). Physiologisches Inst.

INFLUENCE OF VARIOUS PARAMETERS ON THE V'O2 FREQUENCY RESPONSE OF THE BODY. A THEORETICAL STUDY ON THE BASIS OF A NONLINEAR MODEL

DIETER ESSFELD and UWE HOFFMANN /In ESA, Fourth European Symposium on Life Sciences Research in Space p 103-106 Nov. 1990 Submitted for publication (Contract BMFT-01-QV-87354) Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

During aerobic exercise oxygen uptake kinetics at the pulmonary capillary site is influenced, among others, by: magnitude and kinetics of exercise induced changes in cardiac output and muscle oxygen uptake, basal cardiac output and oxygen uptake, magnitude and distribution of the venous volume. A nonlinear computer model is used to study the influence of these parameters on the oxygen uptake frequency response. The results indicate that the contribution of nonlinear responses is negligible for input periods longer than about 1 min. Variations of the muscle oxygen uptake kinetics showed the greatest effect on gain and phase of the oxygen uptake output signal. ESA

N91-19595# Graz Univ. (Austria). Physiologisches Inst. **IS PHYSIOLOGICAL TREMOR (MICROVIBRATION) INFLUENCED BY MICROGRAVITY**

EUGEN GALLASCH, N. BURLATSCHKOWA, I. BELJAJEVA (Institute of Biomedical Problems, Moscow, USSR), M. MOSER, and I. KENNER /In ESA, Fourth European Symposium on Life Sciences Research in Space p 107-110 Nov. 1990 Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

Many studies have been done to analyze the mechanism of tremors, however there are still many controversies. The use of microgravity conditions may open a wide experimental field in which many questions about the origin of tremors can be reinvestigated. In a joint space flight USSR-Austria (Project AUSTROMIR) a program to take tremor recordings at rest and during different tasks from one cosmonaut by means of two accelerometers is prepared. From these measurements new insight into the complex sensori motor interactions of the musculoskeletal control system during adaptation is expected. ESA

N91-19596# Centre National de la Recherche Scientifique, Tours (France). Lab. de Bio-Informatique.

SIMULATION EXPERT SYSTEM FOR PHYSIOLOGICAL MECHANISMS OF THE SPACE MOTION SICKNESS

CLAUDE GAUDEAU, L. GOUTHIERE, C. LETOULLEC, E. LAWTON (Societe de Bio-Informatique et Bio-Technologie, Tours, France), and G. CHAUVET /In ESA, Fourth European Symposium on Life

Sciences Research in Space p 111-116 Nov. 1990 Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

Expert systems are elaborated in numerous scientific sectors in the medical field (diagnostics, antibiotic therapy). They enable a better use of knowledge by introducing a new structure of biological information. The conception of an expert system adapted to the knowledge and the modelization of motion sickness should be a powerful and helpful tool adaptable to different uses: modelization and simulation of motion sickness; early detection of motion sickness by using monitoring of electro-splanchnography; biofeedback training before flight and during flight; preventative and therapy modality of electro stimulation. Nausea is a serious problem for man trying to adapt himself to life in space. The physiological mechanisms of nausea are still very much discussed. It would be useful to view these mechanisms not purely as a specific answer to the general adaptation of life in space. The stressful factor of zero gravity and its consequences bring about a need to be able to adapt quickly to a new situation. Expert systems for modelization of motion sickness mechanisms try to describe effects of motion sickness and the functioning of nervous centers by the knowledge and the determination of their transfer functions. ESA

N91-19597# Innsbruck Univ. (Austria). Klinik fuer Neurology. **NEUROLOGICAL FINDINGS AFTER 72 HOURS WATER IMMERSION**

F. GERSTENBRAND, I. B. KOZLOVSKAYA, MEINHARD BERGER, MIKLOS MAROSI, N. BURLACSKOVA, A. SOKOLOV, R. SCHAUER, and J. RAINER /In ESA, Fourth European Symposium on Life Sciences Research in Space p 117-119 Nov. 1990 Prepared in cooperation with Inst. of Biomedical Problems, Moscow, USSR

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Neurological changes caused by water immersion simulated microgravity were investigated in four male volunteers. All the investigations were performed in the space laboratories for ground based experiments of the Institute for Biomedical Problems, Moscow (USSR). Neurological investigations were carried out before as well as 24, 48 and 72 hours after they were placed in the horizontal water immersion basin. Cerebellar dysfunction, signs of deteriorating function of the peripheral nervous system as well as of the posterior tract and frontal lobe symptoms were observed. Besides those disturbances, compensated cerebral microsymptoms occurred more pronounced in 2 of the 4 volunteers. ESA

N91-19598# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Space Biology Group.

EFFECT OF RUNNING AND HEAD DOWN TILT BEDREST ON LYMPHOCYTE REACTIVITY

FELIX K. GMEUNDER, FRIEDHELM BAISCH, B. BECHLER, AUGUSTO COGOLI, MARIANNE COGOLI, P. W. JOLLER, H. MAASS, J. MUELLER, and W. ZIEGLER (Universitaetsspital, Zurich, Switzerland) /In ESA, Fourth European Symposium on Life Sciences Research in Space p 121-124 Nov. 1990 Sponsored in cooperation with the Swiss Federal Inst. of Tech. (Contract SNSF-3-382-0-86)

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The mitogenic response of lymphocytes was found to be remarkably reduced during and after spaceflight. To test the hypothesis that these observed changes were induced by stress (including psychological and physical stress, or by body fluid redistribution) lymphocyte activation was measured by concanavalin A after running (42 and 21 km) and in a Head Down Tilt (HDT) bedrest study (10 days). Lymphocyte responsiveness was significantly reduced immediately after both runs. The lymphocyte numbers remained constant. Lymphocyte responsiveness was severely reduced prior to, during, and the day after the HDT, even though the lymphocyte numbers did not change. These results are compared with data obtained during and after spaceflight. It

is concluded that the stress of HDT induces changes in immunological responsiveness that are strikingly similar to those arising from the stress of spaceflight. ESA

N91-19599# Milan Univ. (Italy). Cattedra di Semeiotica Medica.
SIMULATED ABSENCE OF GRAVITY IMPAIRS ARTERIAL BARORECEPTOR CONTROL OF HEART RATE IN MAN
G. GRASSI, ANTONELLA RAVOGLI, G. PARATI, P. CORUZZI, A. NOVARINI, and G. MANCIA / In ESA, Fourth European Symposium on Life Sciences Research in Space p 125-127 Nov. 1990
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The bradycardic effects of carotid baroreceptor stimulation (neck chamber technique) of 7 subjects in control condition and during headout water immersion that increased central blood volume, thus simulating absence of gravity, was studied. Water immersion caused a significant arterial blood pressure and heart rate reduction and increased central venous pressure. During immersion baroreceptor stimulation caused less bradycardia ($-19.3 \pm$ or -1 b/minutes) in comparison to that obtained in control condition ($-30.5 \pm$ or -3.0 b/minutes). Thus the baroreflex is impaired under conditions characterized by a central blood volume increase. This phenomenon may be responsible for the alterations in the homeostatic control of circulation often reported during space flights. ESA

N91-19600# Graz Univ. (Austria). Working Group for Volume Regulation and Space Medicine.

A NEW PRINCIPLE FOR DYNAMIC FLUID SHIFT INVESTIGATIONS IN ASTRONAUTS

H. HINGHOFFER-SZALKÁY, EVA MARIA KOENIG, J. SCHMIED, and H. HEIMEL (Labor fuer Messtechnik dr. Hans Stabinger, Graz, Austria) / In ESA, Fourth European Symposium on Life Sciences Research in Space p 129-132 Nov. 1990 Sponsored by Austrian Ministry for Sciences, and Oesterreichische Akademie der Wissenschaften
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A spaceflight experiment which deals with transvascular fluid shifts in astronauts is proposed. The rationale is to compute the amount and the protein content of fluid filtered into interstitial spaces by application of Lower Body Negative Pressure (LBNP) by measuring sound velocity in venous blood and plasma samples drawn from the subject before and during LBNP induced hemoconcentration. Preflight control, and postflight measurements employing an identical protocol should answer the question as to how the permeability within the astronaut leg microvessels is altered by adaptation to spaceflight, and to readaptation to 1 g conditions. A hand held, battery powered equipment which has been newly developed allows for dead space free measurements on blood and plasma samples under ground as well as under micro g conditions. ESA

N91-19601# Deutsche Sporthochschule, Cologne (Germany, F.R.). Physiologisches Inst.

INTRA-INDIVIDUAL VARIABILITY V'O₂ FREQUENCY RESPONSES IN PHYSICALLY ACTIVE SUBJECTS

UWE HOFFMANN, KLAUS BAUM, DIETER ESSFELD, and JUERGEN P. STEGEMANN / In ESA, Fourth European Symposium on Life Sciences Research in Space p 133-135 Nov. 1990 (Contract BMFT-01-QV-87354)

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The reproducibility of individual oxygen consumption frequency responses was studied in 4 highly trained athletes (triathletes) and a group of 4 not specifically endurance trained sports students. Each subject took part in 4 tests at the same daytime, separated by 2 to 5 days. The subjects maintained their everyday physical activities but were requested to avoid extreme physical efforts (competitions) for two days prior to the tests. The results revealed that standard deviations of static and dynamic gains were of the same order. No influence of endurance capacity or forcing frequency could be detected. ESA

N91-19602# Danish Aerospace Medical Center of Research, Copenhagen.

FLUID SHIFTS AND REGULATION OF PLASMA VOLUME IN HUMANS DURING 12 HOURS OF HEAD-OUT WATER IMMERSION

LARS BO JOHANSEN, PETER NORSK, NIELS FOLDAGER, CARSTEN STADEAGER, MANABU KAMEGAI, and FLEMMING BONDE-PETERSEN / In ESA, Fourth European Symposium on Life Sciences Research in Space p 137-139 Nov. 1990 Sponsored by Danish Space Board
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Seven normal males underwent 12 hours of Water Immersion (WI) and a control group of 9 males rested for 12 hours seated in the empty tank. Plasma Volume (PV), as measured with Evans Blue (EB) and the derived Blood Volume (BV), increased initially during WI and then gradually declined to pre immersion levels at 12 hours. PV, as derived from concomitant changes in Hematocrit (Hct) and Hemoglobin (Hb), increased less compared with the EB measurements and then gradually decreased below pre immersion level at 12 hours. Urinary flow rate and sodium excretion rate increased 3 to 4 fold initially and thereafter gradually declined during WI. It is concluded that BV is increased initially during WI, and then reduced to pre immersion level at 12 hours. Changes in Hct and Hb seem to be inaccurate indicators of PV changes during WI. ESA

N91-19603*# Vanderbilt Univ., Nashville, TN. Dept. of Mechanical Engineering.

SKELETAL ADAPTATION IN ALTERED GRAVITY ENVIRONMENTS

TONY S. KELLER and ALVIN M. STRAUSS / In ESA, Fourth European Symposium on Life Sciences Research in Space p 141-147 Nov. 1990 Sponsored by NASA
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It is generally agreed that the single factor that most limits human survivability in non Earth environments is the phenomenon of bone demineralization and the medical problems induced by the subsequent imbalance in the calcium metabolism. Alterations of skeletal properties occur as a result of disturbances in the normal mechanical loading environment of bone. These alterations or adaptations obey physical laws, but the precise mathematical relationship remains to be determined. Principles governing unloading and overloading of bone are gaining more attention as a consequence of the planning of manned space stations, Moon and Mars bases and spaceflights of long duration. A mathematical framework which allows for the prediction of skeletal adaptation on Earth and in non Earth gravity environments by power law relationships is presented. ESA

N91-19604# Freie Univ., Berlin (Germany, F.R.). Dept. of Physiology.

VERTEBRAL COLUMN LENGTH CHANGES DURING SIMULATED MICROGRAVITY

K. A. KIRSCH, FILIPPO CASTRUCCI (Rome Univ., Italy), H.-C. GUNGA, and Y. REINACH / In ESA, Fourth European Symposium on Life Sciences Research in Space p 149-151 Nov. 1990 Sponsored in part by ESA (Contract BMFT-01-QV-87/2)

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The human body in space elongates about 5 cm. A reduction in the gravity dependent curvatures of the Vertebral Column (VC) may be the cause. Thus, VC response to simulated microgravity i.e., bed rest and immersion, employing standard anthropometry (N=5) and photogrammetry (N=1) for 2 hours was monitored. The VC elongated during microgravity simulation with nonlinear fluctuating patterns. Growth was greatest in immersion (2.5 cm) and closer to space observation than bed rest in the same conditions, probably due to reduced sympathetic activity in immersion. It is concluded that VC lengthening seems to be

microgravity dependent. It may also affect some perivertebral structures, contributing to early flight physiological changes. ESA

N91-19605# Max-Planck-Inst. fuer Verhaltensphysiologie, Seewiesen uber Starnberg (Germany, F.R.).

DETERMINANTS OF SPATIAL ORIENTATION IN WEIGHTLESSNESS

HORST MITTELSTAEDT and STEFAN GLASAUER /In ESA, Fourth European Symposium on Life Sciences Research in Space p 153-155 Nov. 1990

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The perception of body position with respect to the vertical and the perception of the vertical in the visual field have turned out to be based on different, only partially overlapping sets of afferent, central and efferent subsystems. A relevant test variable, the deviation of the Subjective Horizontal body Position (SHP) from the objective one, appeared to be correlated with the occurrence of the inversion illusion (and possibly also to symptoms of space sickness) in 5 astronauts (Ss) of the Spacelab 1 and D 1 missions. A reliable predictive test demands a larger number of Ss, a quantitative test of the illusion and separate measurement of the two determinants of the SHP, namely the otolithic bias on the one hand, and the bias of an as yet unidentified gravity system in the human trunk on the other. The present state in the pursuit of three objectives is reported. These include: the measurement of the subjective vertical in the three gravity states of parabolic flight; the comparison of the result with measurements of the SHP on the tiltable board, and the measurement of the relative influence of the unidentified truncal gravity system in paraplegic patients with various locations of the lesion in the spinal cord. Present results indicate that the relevant afferent input enters the spinal cord between the 2nd and the 8th thoracic root. Putative sensors for linear acceleration in the sensory fields of the respective spinal ganglia are discussed. ESA

N91-19606# Wien Univ. (Austria). Neurologische Klinik.

VERTICALLY MOVING VISUAL STIMULI AND VERTICAL VECTION: A TOOL AGAINST SPACE MOTION SICKNESS

CHRISTIAN MUELLER, G. WIEST, and L. DEECKE /In ESA, Fourth European Symposium on Life Sciences Research in Space p 157-161 Nov. 1990

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Vertical vection is a motion illusion that can be elicited by vertical optokinetic stimulation with gaze fixation. Overruling the otolithic and all other sensory canals visual information leads to the perception of lift or pitch vection in a stationary subject. Moving visual cues are used in postural and spatial orientation on Earth. The phenomenon will be examined at the Soviet-Austrian spaceflight in 1991 for the question of an influence on spatial orientation in weightlessness. ESA

N91-19607# Institute of Biomedical Problems, Moscow (USSR). **THE BIOCHEMICAL AND PHYSIOLOGICAL VARIABLES IN MOTION SICKNESS FOLLOWED MODIFIED NEUROENDOCRINE ACTIVITY**

I. A. NICHIPORUK, D. V. GRISHANIN, and A. I. GRIGORIEV /In ESA, Fourth European Symposium on Life Sciences Research in Space p 163-165 Nov. 1990

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Twelve healthy male test subjects showed a significant increase of adrenocorticotropin prolactin, growth hormone and cortisol in placebo, reserpine, methyl dopa, l-dopa and jumex (MAO type B inhibitor) series after laboratory induced Motion Sickness (MS) with practically unchanged activity of renin-angiotensin-aldosterone system and plasma serotonin levels. Reserpine decreased endurance of vestibular rotating test, l-dopa and jumex induced previously absent spatial illusions and shortened latency of motor, visuo, and audio motor responses in 4 test subjects. Critical interval of discretion of visual stimulus was decreased by reserpine and

methyl dopa, and increased by l-dopa and jumex in all subjects. The received results suggest an involvement brain serotonergic and dopaminergic systems in pathogenesis of MS. ESA

N91-19608# Institute of Biomedical Problems, Moscow (USSR). **ASSESSMENT OF BONE TURNOVER IN HUMANS AFTER SPACE FLIGHT AND HYPOKINESIA**

V. S. OGANOV, V. E. NOVIKOV, and A. S. RAKHMANOV /In ESA, Fourth European Symposium on Life Sciences Research in Space p 167-170 Nov. 1990

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The results of studying the bone tissue of cosmonauts after flights (4 to 8 months) were compared to the data of investigating healthy individuals during head down tilt (370 days). A decrease in the vertebral spongy mineral density or an increase of this parameter by a similar magnitude versus the individual preflight values in some cosmonauts was revealed through noninvasive methods (computer tomography, gammaphoton absorptiometry). During studies of clinical cases of osteoporosis it was shown that the vertebral mineral density ratios and presence or absence of vertebral compression fractures in different age groups are nonequal. ESA

N91-19610*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

POSTURAL CHANGES FOLLOWING SENSORY

REINTERPRETATION AS AN ANALOG TO SPACEFLIGHT

WILLIAM H. PALOSKI, D. L. HARM, M. F. RESCHKE, D. D. DOXEY, N. C. SKINNER, L. J. MICHAUD, and D. E. PARKER (Miami Univ., Oxford, OH.) /In ESA, Fourth European Symposium on Life Sciences Research in Space p 175-178 Nov. 1990

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Postural control changes noted in astronauts immediately following spaceflight are thought to be caused by inflight adaptive changes in Central Nervous System (CNS) processing of sensory information from the visual, vestibular, and proprioceptive systems. In order to elicit these adaptive changes in ground based studies, a Tilt Translation Device (TTD) which causes the CNS of exposed subjects to reinterpret tilt generated sensory inputs from the otolith organs as linear translation of the subject was developed. This device was designed to simulate partially the stimulus rearrangement experienced by astronauts during microgravity. Postural stability is assessed in ten subjects before and after 30 minutes of exposure to TTD. The resulting data suggests that exposure to TTD causes decreases in postural stability and shifts in postflight studies of astronauts. It is concluded that the TTD may be an effective weightlessness simulator, and that the postural changes following TTD exposure may provide a useful dependent measure for evaluation of this apparatus. ESA

N91-19611*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

STANDARDIZATION OF MOTION SICKNESS INDUCED BY LEFT-RIGHT AND UP-DOWN REVERSING PRISMS

M. F. RESCHKE, J. M. VANDERPLOEG, E. A. BRUMLEY, J. J. KOLAF, and S. J. WOOD (Krug International, Houston, TX.) /In ESA, Fourth European Symposium on Life Sciences Research in Space p 179-182 Nov. 1990

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Reversing prisms are known to produce symptoms of motion sickness, and have been used to provide a chronic stimulus for training subjects on symptom recognition and regulation. However, testing procedures with reversing prisms have not been standardized. A set of procedures were evaluated which could be standardized using prisms for provocation and to compare the results between Right/Left Reversing Prisms (R/L-RP) and Up/Down Reversing Prisms (U/D-RP). Fifteen subjects were tested with both types of prisms using a self paced walking course throughout the laboratory with work stations established at specified intervals. The work stations provided tasks requiring eye-hand-foot

coordination and various head movements. Comparisons were also made between these prism tests and two other standardized susceptibility tests, the KC-135 parabolic static chair test and the Staircase Velocity Motion Test (SVMT). Two different types of subjective symptom reports were compared. The R/L-RP were significantly more provocative than the U/D-RP. The incidence of motion sickness symptoms for the R/L-RP was similar to the KC-135 parabolic static chair test. Poor correlations were found between the prism tests and the other standardized susceptibility tests, which might indicate that different mechanisms are involved in provoking motion sickness for these different tests. ESA

N91-19612# Danish Aerospace Medical Center of Research, Copenhagen.

INFLUENCE ON NATRIURESIS OF PROLONGED (12 H) WATER IMMERSION ON CENTRAL HEMODYNAMICS AND ENDOCRINE ELEMENTS IN HUMANS

CARSTEN STADEAGER, PETER NORSK, LARS BO JOHANSEN, JORGEN WARBERG, NIELS JUEL CHRISTENSEN, and FLEMMING BONDE-PETERSEN /In ESA, Fourth European Symposium on Life Sciences Research in Space p 183-185 Nov. 1990

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Nine healthy males were randomized to 12 hours of thermoneutral Water Immersion (WI) to the neck and a corresponding seated time control period. The WI induced increase in Central Venous Pressure (CVP) was reduced by 38 percent after 12 hours probably due to the increase in renal sodium and water excretion. The decrease in Plasma Renin Activity (PRA) and Plasma Aldosterone (PA) concentration was maintained during the 12 hours of WI and thus not influenced by the gradual decrease in CVP. Plasma Atrial Natriuretic Peptide (ANP) concentration decreased to prestudy levels at the 12th hour of WI following an initial 3 fold increase. In conclusion, natriuresis of prolonged central hypervolemia decreases CVP. Changes in PRA, PA and ANP may mediate the natriuretic response to WI but during prolonged circumstances, changes in CVP, hormonal concentrations and renal sodium excretion are dissociated. ESA

N91-19613# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

VESTIBULAR TESTS ON UK ASTRONAUT CANDIDATES FOR AN ANGLO/RUSSIAN SPACE FLIGHT (JUNO MISSION)

J. R. R. STOTT and ALAN J. BENSON /In ESA, Fourth European Symposium on Life Sciences Research in Space p 187-190 Nov. 1990

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Tests of vestibular function and motion sickness susceptibility were carried out on 16 candidates from whom the one to fly on a Russian space flight would be chosen. Oculomotor responses to angular oscillation, stopping stimuli and caloric stimulation revealed no significant impairment. Motion sickness susceptibility was assessed by two tests: one, intermittent Coriolis stimulation, the other, horizontal linear oscillation at 0.2 Hz + or - 4 m/sq sec. Thirteen candidates failed to complete the Coriolis test whereas all but four withstood the oscillatory stimulus. Measures of susceptibility on the two tests had a significant (p less than 0.01) rank order correlation. ESA

N91-19614# Institute for Endocrinological and Metabolic Diseases, Rome (Italy). Unit for Endocrinological and Metabolic Diseases.

HEAD-DOWN TILT TEST AND SPACE-RELATED ENDOCRINE PHYSIOLOGY

FELICE STROLLO, G. STROLLO, H. MORE, and G. RIONDINO /In ESA, Fourth European Symposium on Life Sciences Research in Space p 191-195 Nov. 1990

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Tilt Test (TT) Aldosterone/Cortisol (Aldo/F) results were

compared to those occurring during Supine Position (SP) or during Glucose Challenge Test (GCT) and to check for any other endocrine disturbance during TT. It was found that: Aldo and F were inhibited by both TT and GCT; renin decreased during TT, but AI did not; growth hormone slightly increased and prolactin slightly decreased. Possible explanations are discussed. It is concluded that TT may help better designing of good simulation endocrine protocols in space physiology. ESA

N91-19615# Karolinska Inst., Stockholm (Sweden). Dept. of Baromedicine.

EFFECTS OF TRAINING WITH REDUCED PERFUSION PRESSURE ON PERFORMANCE AND MUSCLE FIBER CHARACTERISTICS

CARL J. SUNDBERG, O. EIKEN, M. ESBJOERNSSON, A. NYGREN (Karolinska Hospital, Stockholm, Sweden), and L. KAIJSER /In ESA, Fourth European Symposium on Life Sciences Research in Space p 197-198 Nov. 1990

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Endurance training increases Performance Time (PT) during incremental exercise and may increase the Type 1 fiber percentage, capillary supply and oxidative enzyme content in skeletal muscle. Several factors alone or in combination may trigger these responses, e.g., hypoxia, ischemia, substrate deficiency or flux through aerobic metabolism. Leg exercise in microgravity is associated with reduced perfusion pressure, thus creating a relative ischemia compared to upright exercise at 1 G. The effects of training with reduced muscle perfusion (Ischemia) and training with non restricted muscle blood flow on endurance capacity and muscle fiber characteristics are compared. ESA

N91-19616# Karolinska Inst., Stockholm (Sweden). Environmental Physiology Lab.

MUSCLE FUNCTION IMPAIRMENT FOLLOWING LOWER LIMB UNLOADING IN MEN

PER A. TESCH, HANS E. BERG, T. HAEGGMARK, H. OHLSEN, and G. A. DUDLEY (Bionetics Corp., Cocoa Beach, FL.) /In ESA, Fourth European Symposium on Life Sciences Research in Space p 199-200 Nov. 1990

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Effects of microgravity on skeletal muscle mass and function was simulated in humans. Unilateral lowerlimb unloading was conducted in six healthy men by suspending one lower limb while walking on crutches. Muscle strength (Peak Torque (PT)) was measured during maximal unilateral concentric or eccentric quadriceps actions before and after four weeks of suspension. Thigh muscle Cross Sectional Area (CSA) was assessed by computerized tomography. PT decreased (p less than 0.05) by 22 percent in response to unloading. Four days later PT was still lower (11 percent; p less than 0.05) than before. Muscle CSA decreased (p less than 0.05) by 7 percent and the control limb showed no changes after suspension. It is suggested that this model of unloading could serve to simulate microgravity because reductions in skeletal muscle mass and strength were of similar magnitude to those produced by bedrest or space flight. ESA

N91-19617# Institute of Biomedical Problems, Moscow (USSR).

THE BIOLOGICAL AND MEDICAL PROGRAMME OF THE MANNED ARAGATZ MISSION ON THE MIR SPACE STATION

A. KOTOVSKAIA and DIDIER VASSAUX (Centre National de la Recherche Scientifique, Paris, France) /In ESA, Fourth European Symposium on Life Sciences Research in Space p 207-214 Nov. 1990

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The program of biological and medical experiments within the Aragatz program was a logical extension of French-Soviet cooperation in the space biology and medicine fields, and particularly of the studies carried out during the first French-Soviet flight on the Salyut 7 station in 1982, which were continued during the 237 day flight of 1984. This program filled about half the

planned crew workload and covered the main topics of space physiology and medicine. The measurements taken on the crew before the flight, during the first half of the mission, and shortly before and after their return to Earth correspond to seven experiments, two of which were performed exclusively on the ground. The overall aim was to make pertinent use of a flight having an original duration of four weeks to gain a deeper understanding of the physiological mechanisms involved in the adaptation to weightlessness and, more generally, to the space environment. ESA

N91-19618# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

GRAVITY EFFECTS ON CELLS

DICK A. M. MESLAND *In its* Fourth European Symposium on Life Sciences Research in Space p 221-225 Nov. 1990
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Since the first flight of the ESA Biorack on the German Spacelab Mission D1 in 1985 evidence has been obtained that biological cells and small unicellular organisms function differently under conditions of microgravity. However, there is still a lack of scientific proof that these effects are caused by a direct influence on the cells in the weightlessness condition. The question as to how normal gravity may play a role in cellular activity is being addressed and the results show that gravity may provide important signals during certain state transitions in the cell. These would be gravity sensitive windows in the biological process. Also, by amplification mechanisms inside the cell, the cell may assume a state that is typical for normal gravity conditions and would change in microgravity. Experimental tools that would provide the conditions to obtain evidence for direct action of gravity and for the possible existence of gravity sensitive windows are discussed. ESA

N91-19619# Institut National de la Santé et de la Recherche Médicale, Nice (France). Faculty of Medicine.

EXPERIMENT LYMPHOCYTES OF ARAGATZ MISSION: INFLUENCE OF THE SPACE FLIGHT ON HUMAN T LYMPHOCYTE AND MONOCYTE FUNCTIONS

LAURENCE SCHAFFAR, IRENA V. KONSTANTINOVA, S. MANIE, I. SEROV, J. P. BREITTMAYER, I. N. ANTROPOVA, I. E. VOROTNIKOVA (Institute of Biomedical Problems, Moscow, USSR), and B. FERRUA *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 227-228 Nov. 1990 (Contract CNES-89/1263)
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During the last French-Soviet Aragatz mission the experiment Lymphocytes aimed at analyzing the effects of a long duration space flight on the capacity of human T lymphocytes and monocytes to be activated. Peripheral blood from five cosmonauts sampled 24 hours after recovery of a long duration flight (26 to 166 days) was examined and it was found that T lymphocytes were affected by long duration space flights. The amount of secreted Interleukin 2 (IL2), which represents the major cytokine regulating T cell proliferation, appeared to be significantly enhanced whereas the biological activity of IL2 was decreased. On the other hand, T lymphocytes from 2 cosmonauts out of 5 were not able to normally express IL2 receptor in response to a mitogen. Circulating monocytes were shown to be functional after the space flight and cannot be at the origin of the observed T lymphocyte dysfunctions. ESA

N91-19630# Centre Hospitalier Univ. Purpan, Toulouse (France). Lab. de Biologie Cellulaire.

HUMAN DERMAL FIBROBLAST SENSITIVITY TO HYPERGRAVITY

YOLANDE GAUBIN, F. CROUTE, D. HARTMANN (Pasteur, Louis Univ., Lyon, France), B. PIANEZZI, and J. P. SOLEIHAVOUP *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 281-283 Nov. 1990

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The effects of 10 day chronic hypergravity (2 to 15 G) on cellular functions of human dermal fibroblasts in vitro was investigated. Proliferation or mitogenic response to II sub 1, DNA and protein contents were unaffected by hyper-g culture conditions. Glyceraldehyde-3-P dehydrogenase and pyruvate kinase activities were not disturbed whereas glucose-6-P dehydrogenase was enhanced in a range of 10 to 15 percent. The release of type 1 and 3 collagen, appreciated by a radioimmunoassay, was very similar in control or g-exposed cultures. Nevertheless, indirect immunofluorescence labelling of cell layer type 1 collagen revealed extracellular fibrillar networks in hyper-g exposed cells whereas controls showed a sparse cytoplasmic staining. Elastase activity was increased by about 10 percent. These results suggest that hypergravity could induce changes in the program of extracellular matrix synthesis and the remodeling of its molecules. ESA

N91-19633# Alicante Univ. (Spain). Dept. de Neuroquímica. MICROGRAVITY, HYPERGRAVITY, AND AGING: A UNIFYING HYPOTHESIS

JAIME MIQUEL, E. RAMIREZ, M. C. HOLGADO, E. DEJUAN, and R. MARCO (Universidad Autonoma de Madrid, Cantoblanco, Spain) *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 295-300 Nov. 1990 Sponsored in part by Ministerio de Educacion y Ciencia (Contract CICYT-ESP-88-0351)

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The data from astronauts and cosmonauts as well as from animal experiments showed that long term exposure to near zero G could exert an influence on physiological processes. Research suggests that at least one of these processes, namely aging, may be quite responsive to abnormal G loads. Data is reviewed and theoretical concepts on the relationship between gravity and aging are presented. They propose a general behavioral-metabolic theory of modulation of aging in abnormal gravity fields, which can be subjected to the experimental test by further clinostat, and space laboratory work, in which both the rate of aging and the metabolic rate are simultaneously determined. ESA

N91-19642# Institute of Biomedical Problems, Moscow (USSR). HUMAN AND ANIMAL RESULTS ON VESTIBULAR RESEARCH IN SPACE: VERIS

I. B. KOZLOVSKAYA, B. M. BABAEV, V. A. BARMIN, I. N. BELOOZEROVA, L. N. KORNILOVA, M. G. SIROTA, and S. B. YAKUSHIN *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 353-357 Nov. 1990

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The vestibular function in microgravity environment was examined in men and monkeys using as models optokinetic and optomotor reactions in the former and the gaze fixation reaction, based on the eye-head coordination mechanisms, in the latter. Kinematic parameters of eye and head movements as well as neuronal activity of different parts of the vestibular system, i.e. vestibular nuclei, floccular lobe of cerebellum and vestibular fibers were recorded in both cases. The duration of space flights in both cases was 7 to 12 days. The study revealed in space significant changes at the oculomotor and neuronal response pointing to an increase of the dynamic vestibular excitability along with a diminishing of the static vestibular activity. The time course variations of various parameters under study in flight were similar and reflected adaptation of the control system to the new vestibular environment. ESA

N91-19644# Milan Univ. (Italy). Ist. di Clinica Medica Generale. BLOOD PRESSURE MATURATION CURVE IN NORMOTENSIVE RATS DURING GROWTH IN SIMULATED MICROGRAVITATIONAL ENVIRONMENT

FABIO MAGRINI, M. CIULLA, R. MEAZZA, and P. REGGIANI *In* ESA, Fourth European Symposium on Life Sciences Research in Space p 363-365 Nov. 1990 Prepared in cooperation with

Italian Space Agency, Rome

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Systolic blood pressure, heart rate, urinary output and body weight were measured at 10 day intervals from the age of 30 days (weaning) to 150 days in 12 male Sprague-Dawley rats. When compared to the six control rats, the six test rats kept (between the age of 30 and 90 days) in dry water immersion exhibited a downward shift in systolic blood pressure and body weight maturation curve. It is concluded that the physiological rise in systolic blood pressure taking place in rats during growth is partly dependent on gravitational stimulation. ESA

N91-19651# Milan Univ. (Italy). Ist. di Fisiologia Umana.

GRAVITY DEPENDENCE OF PLEURAL LIQUID TURNOVER

GIUSEPPE MISEROCCHI and DANIELA NEGRINI /in ESA, Fourth European Symposium on Life Sciences Research in Space p 397-399 Nov. 1990

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The turnover rate of pleural fluid as an experimental model to investigate the interstitial space physiology, in particular its dependence on the gravitational field was studied. Data was gathered in anesthetized animals (rabbits and dogs) breathing spontaneously. Using either cannulas or micropipettes the gravity dependent distribution of the pressure of the pleural liquid and the pressure in the parietal pleural interstitium was measured. The intrapleural gravity dependent pleural liquid flows were also measured by detecting with a gamma camera the interpleural movement of technetium labelled albumin. The data allowed a functional model for the filtration absorption interaction to be depicted displaying the following features: pleural liquid is mainly filtered in the less dependent regions of the pleural space; it flows towards the lowermost regions of the cavity where it is drained by the lymphatic action. How exposure to zero g may interfere with the above model, and whether limitations exist, in terms of human adaptation to lack of gravity, considering that lymphatic distribution within the body essentially complies with a physiological gravity dependent absorption, is discussed. ESA

N91-19680# Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (Germany, F.R.). Botanisches Inst.

GENETIC RISK AND PHYSIOLOGICAL STRESS INDUCED BY HEAVY IONS

A. R. KRANZ /in ESA, Fourth European Symposium on Life Sciences Research in Space p 559-563 Nov. 1990 (Contract BMFT-01-QV-85650)

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For the evaluation of heavy ion radiation to human beings on Earth and in space, complete estimation of the total damage (gene mutation, chromosome aberration, cell lethality) of an individual (high-ionizing high energy particles) ion hit is needed. For this the resting embryo of the Arabidopsis seed was a successful test subject in accelerator and space flight experiments. The high-ionizing high energy particles' effect on the genetic lethality, tumorization and the physiological germination and flowering were investigated. The observed endpoints of the heavy ion effect correlated with energy and charge of the high-ionizing high energy particles and the target size of cell nucleus. Particular high-ionizing high energy particles cross sections and specific damage endpoints were obtained resembling both the physiological stress and genetic risk. ESA

N91-19687# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.

CENTRAL AND PERIPHERAL CARDIOVASCULAR RESPONSES TO ELECTRICALLY INDUCED AND VOLUNTARY LEG EXERCISE

B. SALTIN, S. STRANGE, J. BANGSBO, C. K. KIM, M. DUVOISIN, A. HARGENS, and P. D. GOLLNICK (Washington State Univ., Pullman.) /in ESA, Fourth European Symposium on Life Sciences

Research in Space p 591-595 Nov. 1990

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With long missions in space countermeasures have to be used to secure safe operations in space and a safe return to Earth. Exercises of various forms have been used, but the question has arisen whether electrically induced contractions of muscle especially sensitive to weightlessness and crucial for man's performance would aid in maintaining their optimal function. The physiological responses both to short term and prolonged dynamic exercise performed either voluntarily or induced by electrical stimulation were considered. The local and systemic circulatory responses were similar for the voluntary and electrically induced contractions. The metabolic response was slightly more pronounced with electrical stimulation. This could be a reflection of not only slow twitch (type 1) but also fast twitch (type 2) fibers being recruited when the contractions were induced electrically. Intramuscular pressure recordings indicated that the dominant fraction of the muscle group was engaged regardless of mode of activation. Some 70 percent of the short term peak voluntary exercise capacity could be attained with electrical stimulation. Thus, electrically induced contractions of specific muscle groups should indeed be considered as an efficient countermeasure. ESA

N91-19688# Sheffield Univ. (England). Dept. of Medical Physics and Clinical Engineering.

VISUALISATION OF FLUID SHIFTS WITHIN THE BODY DURING A PARABOLIC FLIGHT BY MEASUREMENTS OF ELECTRICAL BIO-IMPEDANCE

FRANK J. MCARDLE, DAVID GRUNDY, B. H. BROWN, and D. C. BARBER /in ESA, Fourth European Symposium on Life Sciences Research in Space p 597-602 Nov. 1990

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In recent years, a tomographic version of the four electrode method of measuring electrical impedance was developed which can produce low resolution images of resistivity changes within the human body. The use of this technique to demonstrate fluid shifts into and out of the thorax of four subjects during a parabolic flight campaign is investigated. Sequences of images were collected, at one second intervals, during parabolic maneuvers in sitting, standing and supine postures and the resistivity changes in the cardiovascular structures, the lungs and in the spinal region are described. The results illustrate the possibilities of this new non-invasive technique for monitoring subjects during spaceflight. The equipment required can be made small enough to be worn by the subject. ESA

N91-19689# Lyon-1 Univ., Villeurbanne (France). Lab. d'Environ. Physiologie.

VOLUME REGULATING HORMONES, FLUID AND ELECTROLYTE MODIFICATIONS DURING THE ARAGATZ MISSION (MIR STATION)

GUILLEMETTE GAUQUELIN, G. GEELEN, C. GHARIB, A. I. GRIGORIEV, ANTONIO GUELL, R. KVETNANSKY, L. MACHO, V. NOSKOV, P. PASI, J. SOUKANOV (Institute of Biomedical Problems, Moscow, USSR) et al. /in ESA, Fourth European Symposium on Life Sciences Research in Space p 603-608 Nov. 1990 Sponsored in part by CNES

(Contract DRET-89-237)

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During a 25 day flight on board the MIR station parameters involved in blood volume regulation were studied. Blood samples were taken to determine electrolytes and osmolality. Epinephrine, norepinephrine, dopamine, Anti Diuretic Hormone (ADH), Atrial Natriuretic Factor (ANF), Plasma Renin Activity (PRA), aldosterone, and cortisol, were measured at days 9 and 20 of the spaceflight. Urine was collected at days 5 and 19 to measure the same parameters (except PRA). The modifications of these hormones (generally increased) are discussed and compared to previous flights. Three factors may account for the results, especially the

increase in ADH: the well known initial fluid shift in weightlessness and the adaptative mechanisms following this phase, stress, and environmental factors (CO₂ and temperature). ESA

N91-19691# Academy of Sciences (USSR), Moscow.
THE REFERENCE SYSTEMS FOR TACTILE PERCEPTION AND FOR THE ORIENTATION WITH RESPECT TO BODY
 VICTOR S. GURFINKEL, F. LESTIENNE, Y. S. LEVICK, K. E. POPOV, and L. LEFORT (Centre National de la Recherche Scientifique, Paris, France) / In ESA, Fourth European Symposium on Life Sciences Research in Space p 611-615 Nov. 1990
 Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

The state of spatial orientation systems in microgravity is investigated. The perception of the orientation of complex tactile stimuli (letters and numbers) applied to the different skin areas in different positions of body parts was studied in the conditions of prolonged space flight by means of special tactile matrix. In the tactile perception task in microgravity, the reaction time was the same as on the Earth and the number of mistakes was even less than the preflight testing. The process of drawing ellipses in air by arm motions with long axis oriented parallel or perpendicularly to the longitudinal body axis was studied with the aid of kinesiograph. The orientation of the ellipses relative to the body axis in weightlessness was the same as in preflight tests in standing conditions. It is concluded that a egocentric reference system ensures the normal performance in many sensorimotor tasks in the absence of gravitational reference. ESA

N91-19692# Centre National de la Recherche Scientifique, Paris (France). Lab. de Physiologie Neurosensorielle.

GAZE CONTROL AND SPATIAL MEMORY IN WEIGHTLESSNESS

CLAUDIE ANDRE-DESHAYS, I. ISRAEL, A. BERTHOZ, K. E. POPOV, and M. I. LIPSCHITS (Academy of Sciences, USSR, Moscow) / In ESA, Fourth European Symposium on Life Sciences Research in Space p 617-621 Nov. 1990 Sponsored by CNES
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Visual information is quite important for spatial orientation, and still more necessary when other sensory inputs may be altered, as in weightlessness. In order to study gaze control, during the long duration flight named Aragatz on board of the MIR Space Station, a series of experiments were performed which explored the different oculomotor subsystems involved in the control of gaze during orientation to a fixed visual target and when tracking a moving target, and the performances of the saccadic system during orientation to remembered target positions, in complete darkness. Two cosmonauts participated in these experiments. The results showed changes in the saccadic system with a decrease of reaction time (an increase in eye peak velocity, an improvement of saccade accuracy), and an increase of the memory guided saccades. ESA

N91-19693# Amsterdam Univ. (Netherlands).

PUPIL SIZE IN PARABOLIC FLIGHT

HENDRIKA W. KORTSCHOT, WILHELMUS J. OOSTERVELD, and H. A. A. DEJONG / In ESA, Fourth European Symposium on Life Sciences Research in Space p 623-624 Nov. 1990 Sponsored by Space Research Organization Netherlands
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The pupil size was observed in ten human test subjects during parabolic flight. Microgravity induces a pupillary dilation, whereas in periods of high gravity load a constriction of the pupil is seen. The assumption of a vestibulo pupillary reflex mechanism can explain these findings. In animals connections are described between the vestibular nuclei and the centers to regulate the pupil size. It is most likely that in humans such structures also exist. ESA

N91-19694# Centre National de la Recherche Scientifique, Paris (France). Lab. de Physiologie Neurosensorielle.

MENTAL ROTATION OF THREE-DIMENSIONAL SHAPES IN MICROGRAVITY

YOANI MATSAKIS, A. BERTHOZ, M. I. LIPSCHITS, and VICTOR S. GURFINKEL (Academy of Sciences, USSR, Moscow) / In ESA, Fourth European Symposium on Life Sciences Research in Space p 625-629 Nov. 1990
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Previous experiments have suggested that gravity could exert a constraint on visual image processing. This hypothesis was investigated using a mental rotation task involving three dimensional objects during a 26 day orbital flight aboard the Soviet MIR Station. The analysis of cosmonauts' response times showed that the average rotation time per degree was shorter in flight than on ground. This decay seemed to be mainly attributable to responses implying roll axis rotations. These results are congruent with the gravity constraint hypothesis in the sense that weightlessness provided a release of this constraint, modifying the dynamic characteristics of the rotation process. As roll rotations do not alter the two dimensional image of objects' projection onto the retina, mental rotation processes could apply differently to two dimensional retinotopic or viewer centered representations and to three dimensional object centered representations. ESA

N91-19695# Deutsche Sporthochschule, Cologne (Germany, F.R.). Inst. fuer Physiologie.

WEIGHTLESSNESS COUNTERMEASURES AND HUMAN PHYSIOLOGY IN SPACE: A POTENTIAL CONFLICT

JUERGEN P. STEGEMANN / In ESA, Fourth European Symposium on Life Sciences Research in Space p 631-635 Nov. 1990
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Experimental results revealed that the strength of partially atrophic muscles can be regained with relatively small effort. The designing of physical training for long term missions which does not disturb the well being of astronauts is discussed. Derived from some theoretical aspects, it is proposed to reduce their work capacity to 80 percent during about two thirds of the mission time, and then to train them up to their initial work capacity. This might overcome the psychological problems associated with extensive training time. Furthermore, food and oxygen are saved. A device which should allow astronauts to combine scientific work with their fitness program is presented. Potential conflicts between health maintenance and research activities are outlined. ESA

N91-19710*# Good Samaritan Hospital and Medical Center, Portland, OR. Clinical Vestibular Lab.

RELATION BETWEEN PERCEPTION OF VERTICAL AXIS ROTATION AND VESTIBULO-OCULAR REFLEX SYMMETRY

ROBERT J. PETERKA and MARTHA S. BENOLKEN 20 Mar. 1991 21 p
 (Contract NAG9-117)
 (NASA-CR-187997; NAS 1.26:187997) Avail: NTIS HC/MF A03 CSCL 06/16

Subjects seated in a vertical axis rotation chair controlled their rotational velocity by adjusting a potentiometer. Their goal was to null out pseudorandom rotational perturbations in order to remain perceptually stationary. Most subjects showed a slow linear drift of velocity (a constant acceleration) to one side when they were deprived of an earth-fixed visual reference. The amplitude and direction of this drift can be considered a measure of a static bias in the subject's perception of rotation. The presence of a perceptual bias is consistent with a small, constant imbalance of vestibular function which could be of either central or peripheral origin. Deviations from perfect vestibuloocular reflex (VOR) symmetry are also assumed to be related to imbalances in either peripheral or central vestibular function. Researchers looked for correlations between perceptual bias and various measures of vestibular reflex symmetry that might suggest a common source for both reflective and perceptual imbalances. No correlations were found.

Measurement errors could not account for these results since repeated tests on the same subjects of both perceptual bias and VOR symmetry were well correlated. Author

N91-19711*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.

RESPONSES OF WOMEN TO ORTHOSTATIC AND EXERCISE STRESSES Technical Report, 1976 - 1977

G. W. HOFFLER, M. M. JACKSON, R. L. JOHNSON, J. T. BAKER, and D. TATRO (Bionetics Corp., Cocoa Beach, FL.) Washington Oct. 1990 77 p
(Contract NAS9-14880; NAS10-11624)
(NASA-TP-3043; NAS 1.60:3043) Avail: NTIS HC/MF A05
CSCL 06/16

The results are presented from a special physiological study of women at the Johnson Space Center in 1976 to 1977. Its purpose was to establish a large (98 subjects) database from normal working women. The data sets are medical historical, clinical, anthropometric, and stress response statistics useful for establishing medical criteria for selecting women astronauts. Stressors were lower body negative pressure and static standing (both orthostatic) and treadmill exercise (ergometric). Data shown are original individual values with analyses and subsets, and statistical summaries and correlations relating to human responses to microgravity. Similarities appear between the characteristics of women in this study and those of women astronauts currently flying in Shuttle crews. Author

N91-19712# Brookhaven National Lab., Upton, NY.
MULTIPLE ENERGY COMPUTED TOMOGRAPHY FOR NEURORADIOLOGY WITH MONOCHROMATIC X RAYS FROM THE NATIONAL SYNCHROTRON LIGHT SOURCE

F. A. DILMANIAN, R. F. GARRETT, W. C. THOMLINSON, L. E. BERMAN, L. D. CHAPMAN, N. F. GMEUR, N. M. LAZARZ, H. R. MOULIN, T. OVERSLUIZEN, D. N. SLATKIN et al. 1990 20 p
Presented at the 3rd International Conference on Applications of Physics in Medicine and Biology: Medical Diagnostic Imaging, Trieste, Italy, 4-7 Sep. 1990
(Contract DE-AC02-76CH-00016)
(DE91-008108; BNL-45750; CONF-900993-2) Avail: NTIS
HC/MF A03

Monochromatic and tunable 33 to 100 keV x rays from the X17 superconducting wiggler of the National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory (BNL) will be used for computed tomography (CT) of the human head and neck. The CT configuration will be one of a fixed horizontal fan-shaped beam and a seated rotating subject. The system, which is under development, will employ a two-crystal monochromator with an energy bandwidth of about 0.1 percent, and high-purity germanium linear array detector with 0.5 mm element width and 200 mm total width. Narrow energy bands not only eliminate beam hardening but are ideal for carrying out the following dual-energy methods: (1) dual-photon absorptiometry CT, that provides separate images of the low-Z and the intermediate-Z elements; and (2) K-edge subtraction CT of iodine and perhaps of heavier contrast elements. As a result, the system should provide approximately 10-fold improvement in image contrast resolution and in quantitative precision over conventional CT. A prototype system for a 45 mm subject diameter will be ready in 1991, which will be used for studies with phantoms and small animals. The human imaging system will have a field of view of 200 mm. The in-plane spatial resolution in both systems will be 0.5 mm FWHM. DOE

N91-20030*# North Carolina Univ., Greensboro. Dept. of Mathematics and Statistics.

CAROTID-CARDIAC BAROREFLEX INFLUENCE ON FOREARM VASCULAR RESISTANCE DURING LOW LEVEL LBNP

DAVID LUDWIG in NASA, John F. Kennedy Space Center, Research Reports: 1990 NASA/ASEE Summer Faculty Fellowship Program p 222-243 Sep. 1990
(Contract NGT-60002)
Avail: NTIS HC/MF A23 CSCL 06/16

Twelve healthy males were tested at low levels of lower body

negative pressure (LBNP) with and without artificial stimulation of the carotid-cardiac baroreceptors. The carotid-cardiac baroreceptors were stimulated by applying a pressure of 10 mmHg to the carotid artery via a pressurized neck chamber. During the procedure, forearm blood flow (FBF) and forearm vascular resistance (FVR) were measured using a Whitney mercury silastic strain gauge technique. FBF decreased while FVR increased with increased intensity of LBNP. Both FBF and FVR were unaffected by carotid-cardiac baroreceptor stimulation. Author

N91-20608*# George Washington Univ., Washington, DC. Science Communication Studies.

SPACE MEDICINE RESEARCH PUBLICATIONS: 1987-1988

Feb. 1991 130 p
(Contract NASW-4324)
(NASA-CR-187840; NAS 1.26:187840) Avail: NTIS HC/MF A07
CSCL 06/16

A list of publications of investigators supported by the Biomedical Research and Clinical Programs of the Life Sciences Division, Office of Space Science and Applications is given. Included are publications entered into the Life Sciences Bibliographic Database by the George Washington University as of 31 December 1988. Principal Investigators whose research tasks resulted in publication are identified by asterisk. Publications are organized into the following subject areas: space physiology and countermeasures (cardiopulmonary, musculoskeletal, neuroscience, and regulatory physiology), space human factors, environmental health, radiation health, clinical medicine, and general space medicine. Author

N91-20609# Duke Univ., Durham, NC. Div. of Allergy, Critical Care, and Respiratory Medicine.

STRUCTURE OF THE GAS EXCHANGE REGION OF THE LUNGS DETERMINED BY THREE-DIMENSIONAL RECONSTRUCTIONS

R. R. MERCER and J. D. CRAPO 1990 30 p Submitted for publication Sponsored by Health Effects Research Lab., Research Triangle Park, NC
(Contract EPA-R-813113)
(PB91-133017; EPA/600/D-90/163) Avail: NTIS HC/MF A03
CSCL 06/16

Data obtained from animal exposures may, if appropriately extrapolated, be used to assess quantitatively the health risks of humans chronically exposed to environmental airborne pollutants. The ability to make correct extrapolations is critical in making full use of the results of acute and chronic exposures in laboratory animals. Extrapolation of experimental results between different animal species requires several types of data, one of which is detailed data on the geometry of the lungs for each species, to determine the quantity of pollutant that reacts (or is deposited) in the various anatomic regions (trachea, bronchi, bronchioles, terminal bronchioles, proximal alveolar and distal alveolar regions). Data on the geometry of the lungs are almost exclusively concerned with the geometry of the major airways. The concentration of previous work on the major airways reflects the fact that they are the major determinants of airway resistance. GRA

N91-20610# Aerospace Medical Research Labs., Wright-Patterson AFB, OH.

SUBJECTIVE RESPONSES TO POSITIVE PRESSURE BREATHING UNDER SUSTAINED HIGH-G USING THE COMBAT EDGE SYSTEM Final Report, Mar. - Aug. 1990

KATHY MCCLOSKEY, LLOYD TRIPP, DANIEL W. REPPERGER, STEPHEN POPPER, and STEPHEN BOLIA Aug. 1990 60 p
(AD-A230019; AAMRL-TR-90-056) Avail: NTIS HC/MF A04
CSCL 06/5

The two studies reported here were conducted during the check-out phase of an assisted positive pressure breathing system, known as COMBAT EDGE, being developed by the U.S. Air Force. Manned centrifuge tests of the regulator which controls air pressure to the oro-nasal mask and counterpressure vest provided an early opportunity to obtain subjective data concerning systems characteristics from subjects under high-G. Subjects underwent

four different high-G profiles: (1) +9Gz maximum (onset rate=0.1G/sec), (2) +5Gz maximum (onset rate=0.5 G/sec), (3) +7Gz maximum (onset rate=0.5 G/sec), and (4) +9Gz maximum (onset rate=0.5 G/sec). Onset of pressure to the mask and vest occurred at +4Gz with a rate of 12 mmHg/g. Maximum pressure was 60 mmHg at +9Gz. Subjects' reports of body pain mostly concerned the elbows and arms, followed by leg, ear, buttock, facial and rib pain. Subjects also reported that the M-1 and L-1 straining maneuvers were not needed as frequently with the COMBAT EDGE system. Tensing of the leg/buttock area was sufficient to counteract the effects of high-G. GRA

N91-20611# Federal Aviation Administration, Washington, DC. Office of Aviation Medicine.

THE FAA ALTITUDE CHAMBER TRAINING FLIGHT PROFILE: A SURVEY OF ALTITUDE REACTIONS, 1965-1989

CHARLES D. VALDEZ Sep. 1990 12 p
(AD-A230057; DOT/FAA/AM-90/12) Avail: NTIS HC/MF A03 CSCL 06/5

Reactions from 1,161 trainees out of 12,759 trainees subjected to the FAA altitude chamber training flights from 1965 to 1989 are annotated in this survey. Although there were some mild and expected reactions, these training profiles appear to provide a safe learning environment without compromising the student's health and safety. Inside chamber instructors did not fare as well, perhaps due to age and cumulative numbers of exposures, and recommendations are suggested for improved safeguards. GRA

N91-20612# Colorado State Univ., Fort Collins. Dept. of Physiology and Biophysics.

THE PHOTOTOXICITY OF BLUE LIGHT ON THE FUNCTIONAL PROPERTIES OF THE RETINAL PIGMENT EPITHELIUM Final Technical Report, 1 May 1987 - 30 Sep. 1990

E. L. PAUTLER 15 Oct. 1990 17 p
(Contract AF-AFOSR-0189-87; AF PROJ. 2312)
(AD-A230072; AFOSR-90-1184TR) Avail: NTIS HC/MF A03 CSCL 06/10

Irradiation of the isolated bovine retinal pigment epithelium with 430 nm light at 20 mW/sq cm inhibited the unidirectional flux of leucine, glutamate and chloride in the retina to choroid direction; however, this intensity also produced discernible damage to the mitochondria. Reducing the level of radiation did not affect any of the transport systems studied. Ascorbate, morin, or vitamin E did not ameliorate the effect of blue light on transport, whereas melatonin did provide protection by forming an effective light filter. The combination of ethanol and exposure to blue light may constitute a health hazard for humans. Retina-derived factor(s) applied to the apical side of the preparation resulted in a stabilization of the TEP and SCC, followed by a secondary rise in both electrical parameters. These results lead to the hypotheses that the neural retina secretes a factor(s) which is essential for the regulation and maintenance of the RPE under normal physiological conditions and may facilitate repair processes in pathological states. GRA

N91-20613# Northeastern Univ., Boston, MA.

CENTER FOR THE STUDY OF RHYTHMIC PROCESSES Annual Report, 1 Oct. 1988 - 31 Dec. 1989

N. KOPELL 1 Dec. 1990 10 p
(Contract F49620-87-C-0013)
(AD-A230166; AFOSR-90-1191TR) Avail: NTIS HC/MF A02 CSCL 06/4

The Center for the Study of Rhythmic Processes continued its work on Central Pattern Generators (CPGs), notably on the vertebrate spinal CPG for undulatory locomotion, and the invertebrate crustacean stomatogastric ganglion (STG). For the lamprey, a primitive vertebrate, experiments were designed and performed involving transduction of mechanical motion to neural activity; these experiments were combined with mathematical theory to help understand the relation of structure to function in that network. Other topics investigated included the effects of long coupling fibers, the relationship between muscle activation and movement, and the ability of the network to regenerate. Work on

the STG included results on neuromodulators that change the output of the network and mathematical modelling of individual cells as well emergent properties of the network. GRA

N91-20614# Northeastern Univ., Boston, MA.

CENTER FOR THE STUDY OF RHYTHMIC PROCESSES Final Report, 1 Oct. 1986 - 30 Apr. 1990

N. KOPELL 1 Dec. 1990 15 p
(Contract F49620-87-C-0013)
(AD-A230271; AFOSR-90-1190TR) Avail: NTIS HC/MF A03 CSCL 06/4

The Center for the Study of Rhythmic Processes began operation in the academic year 1986 to 1989 and was supported as a Center of Excellence through June 1990. The Center gathered together mathematicians and biologists to work on problems involving neural control of rhythmic motor behavior. There were two main problems addressed during this time. One was the structure and function of the intersegmental coordinating system of the vertebrate spinal cord, using the lamprey as the prototypic example. A broadly applicable mathematical framework was developed and applied. The major research Centers of the country working on this preparation were consolidated under the auspices of the Center. The new collaborations led to the design and performance of new experiments based on the mathematics. The second problem was the structure and function of small neural networks, such as the crustacean stomatogastric ganglion. Work was performed on tasks ranging from the biophysics of individual cells to emergent properties of the network. GRA

N91-20615# Naval Health Research Center, San Diego, CA.

NAPPING, STIMULANT, AND FOUR CHOICE PERFORMANCE Interim Report

PAUL NAITOH, TAMSIN L. KELLY, and HARVEY BABKOFF 14 Sep. 1990 35 p
(AD-A230366; NHRC-90-17) Avail: NTIS HC/MF A03 CSCL 06/5

The primary purpose of this paper is to determine whether a short sleep (nap) can maintain human cognitive functions during a long continuous work period. In continuous work environments, the normal 7 to 8 hour period of nocturnal sleep is not allowed. Instead, work continues in time periods longer than 24 hours. A long work period causes cognitive decrements due to fatigue and sleepiness. Can naps prevent such decrements? More specifically, can a sleep/wake schedule of a 20-min sleep every 6 hours prevent cognitive degradation during a continuous work period of 64 hours? The present chapter reports on the effects of the 20-min/340-min sleep/wake schedule on cognitive functions during a 64-hr work period. The 20/340 sleep/wake schedule was chosen for the study on the basis of previously published experimental studies. They suggest that short naps prevent cognitive decrements during a long continuous work period. GRA

N91-20616# Army Research Inst. of Environmental Medicine, Natick, MA.

SUSTAINING HEALTH AND PERFORMANCE IN THE DESERT: ENVIRONMENTAL MEDICINE GUIDANCE FOR OPERATIONS IN SOUTHWEST ASIA Final Report

J. F. GLENN, R. E. BURR, R. W. HUBBARD, M. Z. MAYS, R. J. MOORE, and B. H. JONES 1 Dec. 1990 57 p
(AD-A229643; USARIEM-TN-91-1) Avail: NTIS HC/MF A04 CSCL 05/8

Southwest Asia (SWA) is a harsh and unfamiliar environment for American soldiers. SWA poses a set of hazards unfamiliar to most of the leaders and soldiers who have trained in the temperature and hygienically advanced environments of CONUS or Europe. The primary environmental hazard of SWA is the desert, which has a climate that spans from hot-dry to cold-damp depending on the season and time of day. Yet, there are also coastal areas featuring marshlands which increase the risk of cold injury during the winter. This technical note discusses the environmental hazards of SWA and how to deal with them. Armies have operated in SWA for thousands of years. Some have been successful and some have experienced disaster. An important

difference between success and disaster has been the degree to which armies have stayed fit and healthy in the face of the disease and injury threats of SWA. GRA

N91-20617# New York Univ., New York. Center for Neural Science.

HIGHER ORDER MECHANISMS OF COLOR VISION Technical Report, 15 Jun. 1989 - 14 Jun. 1990

JOHN KRAUSKOPF 19 Nov. 1990 18 p
(Contract AF-AFOSR-0429-89; AF PROJ. 2313)
(AD-A230448; AFOSR-90-1177TR) Avail: NTIS HC/MF A03
CSCL 06/4

This report covers our activities since June 15, 1989. The main accomplishments have been: (1) Completion and publication of a comprehensive study of the effects of chromatic content, blur and contrast of targets on vernier acuity and on stereo acuity; (2) The use of a new method of measuring chromatic discrimination under conditions of constant adaptation; (3) Continuation of the study of the chromatic properties of single cells in the monkey cortex, extending our experiments to Area V2; (4) Experiments on the significance of color in the perception of motion; (5) Experiments on the effects of chromatic adaptation on color matching; and (6) The effects of noise masks on the detection of chromatic and luminance pulses. GRA

N91-20618# Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.

ESTIMATION OF EVOKED FIELDS USING A TIME-SEQUENCED ADAPTIVE FILTER WITH THE MODIFIED P-VECTOR ALGORITHM M.S. Thesis

JEFFERY A. KEPLEY, Dec. 1990 182 p
(AD-A230474; AFIT/EN/GE/90D) Avail: NTIS HC/MF A09
CSCL 09/1

This theses describes a time sequenced adaptive filter developed to estimate visually evoked fields (EF) using visually evoked potentials (EP). These non-stationary signals are buried in strong background noise. The two types of noise are magnetoencephalogram (MEG) and electroencephalogram (EEG). The filter implementation is based on the Ferrara Time Sequenced Adaptive (TSAF) using the Least-Mean-Square (LMS) algorithm and the Williams modified P-vector algorithm (mPa). This essentially results in two filters. A two stage filter structure is used in which the first stage removes the time-varying mean of the input signals. This allows the second stage to process zero-mean signals which increases the convergence speed of the filter. The theory for the two filters is overviewed with the input signals to the filters modelled as the sum of three uncorrelated components: average signal response, signal jitter, and noise. The signal model is verified based on a statistical analysis of simulated EP data files. The software implementation is then shown to be error free. GRA

N91-20619# California Univ., Irvine. Center for Neurobiology of Learning and Memory.

SYNAPTIC PLASTICITY AND MEMORY FORMATION Annual Technical Report, 15 May 1989 - 14 May 1990

GARY LYNCH 5 Dec. 1990 9 p
(Contract AF-AFOSR-0383-89; AF PROJ. 2312)
(AD-A230617; AFOSR-90-1217TR) Avail: NTIS HC/MF A02
CSCL 06/5

Studies were conducted on the induction, expression, and stabilization of long-term potentiation (LTP), a form of synaptic plasticity that is likely to participate in memory encoding. Induction was shown to involve a glycine receptor site that modulates calcium fluxes through a subclass of transmitter receptors. Other results indicated that LTP expression is not likely to involve release or changes in spine increased resistance, but did provide direct evidence that potentiation reflects a change in the conductance properties of post-synaptic receptors. The hypothesis was developed that stabilization of LTP involves a disconnection and reconnection of adhesive relationships that maintain the organization of the synaptic region. This involves a calcium sensitive protease that cleaves cytoskeletal proteins and the exposure of a group of adhesion receptors known as integrins. Together with

results from previous years of support, and from other laboratories, work over the past year has led to a reasonable complete hypothesis concerning how synapses can be rapidly transformed from one stable state to another and thus be used as memory storage devices. GRA

N91-20722*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

ANALYSIS OF THE INDIVIDUAL RISK OF ALTITUDE DECOMPRESSION SICKNESS UNDER REPEATED EXPOSURES

K. VASANTHA KUMAR, DAVID J. HERRIGAN, JAMES M. WALIGORA, and JOHN H. GILBERT (Space Biomedical Research Inst., Houston, TX.) *In its* Fourth Annual Workshop on Space Operations Applications and Research (SOAR 90) p 633-636 Jan. 1991

Avail: NTIS HC/MF A14 CSCL 06/16

In a case-control study, researchers examined the risk of decompression sickness (DCS) in individual subjects with higher number of exposures. Of the 126 subjects, 42 showed one or more episodes of DCS. Examination of the exposure-DCS relationship by odds ratio showed a linear relationship. Stratification analysis showed that sex, tissue ratio, and the presence of Doppler microbubbles were cofounders of this risk. A higher number of exposures increased the risk of DCS in this analysis. Author

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

A91-29450

PART TASK TRAINERS; PROCEEDINGS OF THE CONFERENCE, LONDON, ENGLAND, NOV. 28, 1990

London, Royal Aeronautical Society, 1990, 78 p. No individual items are abstracted in this volume.

Copyright

The current status of part-task trainer (PTT) development in the UK is examined in reviews and reports. Topics addressed include FAA views on PTT standards, the position of the UK CAA on PTTs, practical aspects of maintenance transition training, and the role of PTTs in a large-scale training operation. Consideration is given to PTTs at United Airlines, PTTs in the Fleet Air Arm, PTTs in the RAF, and a low-cost flight trainer for the RAF. T.K.

A91-30967

CHANGES IN TIME ESTIMATING ABILITIES THROUGH WORKLOAD ANALYSIS AS MEASURED BY +GZ ACCELERATION

STEPHEN E. POPPER, DAN W. REPPERGER, JOHN W. FRAZIER (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH), and CHUCK GOODYEAR (Systems Research Laboratories, Inc., Dayton, OH) *IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 862-868. refs*

Copyright

The time estimation of pilots under various workloads was investigated. Eight subjects completed four days of randomized testing and were exposed each day to two simulated aerial combat maneuvering (SACM) profiles of 180-s duration and with a maximum level of +8 Gz. Counting and noncounting (rate projection) tasks were used as time estimation techniques. The time intervals measured were 2, 8, and 16 s. The duration of the noncounting task (the most accurate task to estimate) was found to be greater than 8 s. The production task was much more accurate to estimate

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than the reproduction task, and long-duration tasks were found to be most influenced by the intensity of the G stress, as well as if the G stress was decreasing. I.E.

A91-31299

PSYCHOMETRIC PROPERTIES OF SUBJECTIVE WORKLOAD MEASUREMENT TECHNIQUES - IMPLICATIONS FOR THEIR USE IN THE ASSESSMENT OF PERCEIVED MENTAL WORKLOAD

THOMAS E. NYGREN (Ohio State University, Columbus) Human Factors (ISSN 0018-7208), vol. 33, Feb. 1991, p. 17-33. refs Copyright

This paper examines fundamental measurement issues that have largely been ignored in scaling techniques for assessing perceived mental workload. It is argued that both theoretical and practical advances in workload assessment have been unnecessarily slowed by a lack of concern for measurement issues. Typical of this impedance are some recently reported 'empirical results' comparing various workload assessment techniques which actually follow directly from some misunderstood statistical properties of the scales. The commonly used subjective workload assessment procedures have distinct psychometric properties that make each procedure sensitive to different kinds of workload measurement. Examination of the properties for the NASA Task Load Index (NASA TLX) support its potential as a general prediction model for experienced workload and for the Subjective Workload Assessment Technique (SWAT) as a cognitive model sensitive to individual differences. Author

A91-31446

A TEST OF THUMB AND INDEX FINGER CONTROL IN OVERCOMING A VISUAL ANALOGUE OF THE GIANT HAND ILLUSION

LISA F. WEINSTEIN, FRED H. PREVIC, CARL G. SIMPSON, TERENCE J. LYONS, and KENT K. GILLINGHAM (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, April 1991, p. 336-341. USAF-supported research. refs Copyright

An experiment involving the simulation of the giant hand (GH) phenomenon by using a rotating visual background field to induce the illusion is described. Anecdotal evidence suggests that a thumb and index finger (TI) grip during GH phenomenon may enable a pilot to overcome the illusion. Sixteen pilots took part in the experiment conducted in a darkened booth in the USAF School of Aerospace Medicine's Visual Orientation Laboratory. The effectiveness of TI and whole hand (WH) techniques was compared in overcoming a visually-induced analogue. Results indicate that TI control produces greater stability overall, but does not overcome the specific tracking bias induced by a background visual roll stimulus. Various reasons for the ineffectiveness of the TI technique are discussed. O.G.

A91-31447

INFLIGHT ANXIETY CONDITIONS PRESENTING WITH 'BREAK-OFF' SYMPTOMS

BRUCE BOHNER, JAMES' FRASER, JAMES BAGGETT, and GERARD HAYES (U.S. Navy, Naval Aerospace Medical Institute, Pensacola, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, April 1991, p. 342-345. refs Copyright

The psychological dimension of disorientation is explored through two experienced pilots who developed inflight anxiety conditions. These were associated with 'break-off' symptoms, which are inflight sensations of separation from the ground, the environment, and the aircraft. Following extensive psychiatric and medical evaluations, one aviator was diagnosed as having agoraphobia without panic disorder, and the other as having an otherwise unspecified anxiety disorder. These patient reports demonstrate the need for the clinical aerospace medicine specialist to investigate inflight anxiety conditions for underlying neuropsychiatric disorders. The reports also contrast some of the

historical aeromedical concepts with modern psychiatric diagnostic nomenclature. Author

A91-31449

PSYCHOSOCIAL SUPPORT FOR COSMONAUTS

NICK KANAS (USVA, Medical Center, San Francisco, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, April 1991, p. 353-355. refs Copyright

Based on a meeting with members of Psychological Support Group for cosmonauts, along with several referenced documents, the author summarizes the Soviet experience in dealing with psychological and interpersonal factors related to long-duration space missions. Cosmonaut selection and training procedures following the principle of 'neuropsychological resistance' formulated by Gorbov. Inflight monitoring uses the macroanalysis of crew speech characteristics as an indicator of psychological state. Psychosocial problems include 'asthenia' and interpersonal tension. Support efforts focus on enhancing behavioral and autonomic adaptation, planning flexible work/rest schedules, improving the space station environment, arranging relevant free time activities, and helping crews readjust to earth postflight. Attention is paid to changes in cosmonaut preferences and sensitivities as the mission progresses. The use of support activities is believed to be positively associated with the health and performance of cosmonaut space crews. Author

A91-31495#

TRANSFER EFFECT OF A PRELIMINARY TRAINING ON INSTRUMENTAL RESPONDING IN RAT

MIYAKO OKAUE and HIROSHI FUJIWARA Japan Air Self Defense Force, Aeromedical Laboratory, Reports (ISSN 0023-2858), vol. 30, Dec. 1989, p. 93-105. In Japanese, with abstract in English. refs

Three groups of five rats each were trained in lever-pushing in a skinner box under three different preliminary learning conditions designated FR, FI, and FIFR. Rats of the FR group pushed the lever more frequently than those of the other two groups, with virtually unobservable pauses after reinforcement. The FI group's lever-pushing was less frequent, with clearly observable pauses after reinforcements. Rats in the FIFR group exhibited large individual differences, with some resembling the FI and others the FR rats. In both the FI and FR groups cue stimuli involving a tone and a green light were found to decrease lever-pushing; FIFR-group rats did not exhibit such tendencies. O.C.

N91-19713# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA.

TEST ANALYSIS PROGRAM EVALUATION: ITEM STATISTICS AS FEEDBACK TO TEST DEVELOPERS Final Report, Feb. 1989 - Mar. 1990

PETER J. LEGREE Oct. 1990 17 p (AD-A229851; ARI-RN-91-03) Avail: NTIS HC/MF A03 CSCL 14/2

The test analysis program was evaluated to determine the feasibility of using a personal computer to provide course developers with item statistics. This project was undertaken because of Signal School concern that course tests do not accurately measure student school performance. The evaluation focused on the usefulness of providing item statistics to course test developers and demonstrated that many of the tests contain poorly written items. The evaluation indicates that a computerized test analysis program can be used to identify questionable test items and help ensure Signal School tests are adequate to validate lessons and courses. GRA

N91-20620*# George Washington Univ., Washington, DC. Science Communication Studies.

SPACE HUMAN FACTORS PUBLICATIONS: 1980-1990

KATHERINE J. DICKSON Mar. 1991 14 p (Contract NASW-4324) (NASA-CR-4351; NAS 1.26:4351) Avail: NTIS HC/MF A03 CSCL 05/9

A 10 year cumulative bibliography of publications resulting from research supported by the NASA Space Human Factors Program of the Life Science Division is provided. The goal of this program is to understand the basic mechanisms underlying behavioral adaptation to space and to develop and validate system design requirements, protocols, and countermeasures to ensure the psychological well-being, safety, and productivity of crewmembers. Subjects encompassed by this bibliography include selection and training, group dynamics; psychophysiological interactions, habitability issues, human-machine interactions, psychological support measures, and anthropometric data. Principal Investigators whose research tasks resulted in publication are identified by asterisk. Author

N91-20621# Federal Aviation Administration, Washington, DC. Office of Aviation Medicine.

SELECTION OF AIR TRAFFIC CONTROLLERS FOR AUTOMATED SYSTEMS: APPLICATIONS FROM CURRENT RESEARCH

PAMELA S. DELLAROCO, CAROL A. MANNING, and HILDA WING Nov. 1990 38 p
(AD-A230058; DOT/FAA/AM-90/13) Avail: NTIS HC/MF A03 CSCL 05/9

Over the next two decades, the Federal Aviation Administration's (FAA) plan for new automated systems will change the air traffic control specialist's (ATCS) job as many of the current controller's tasks become automated. The purpose of this paper was to review the findings from current research on selection of ATCS's that may guide the design of selection systems for future controllers. To accomplish this two lines of research were presented: (1) projected changes in job tasks resulting from planned automation, and (2) the current ATCS selection system. A study completed in 1987 estimated that 48 of 337 job tasks of the enroute controller would be substantially changed with implementation of the Initial Sector Suites (ISSS). In light of the projected changes, the current selection system was evaluated in terms of the methodologies used for selection and the utility and validity of those methodologies. The current job is a highly complex set of tasks and demands high levels and active application of certain cognitive abilities, such as spatial perception, information processing, reasoning and decision making. Evaluation of the changes projected in the job over the next two decades suggested that a similar performance-based selection system could maintain utility through implementation of the ISSS. GRA

N91-20622# Naval Postgraduate School, Monterey, CA.
LEARNING CURVE AND RATE ADJUSTMENT MODELS: COMPARATIVE PREDICTION ACCURACY UNDER VARYING CONDITIONS

O. D. MOSES Nov. 1990 40 p
(AD-A230075; NPS-AS-91-001) Avail: NTIS HC/MF A03 CSCL 05/3

Learning curve models have gained widespread acceptance as a technique for analyzing and forecasting the cost of items produced from a repetitive process. Considerable research has investigated augmenting the traditional learning curve model with the addition of a production rate variable, creating a rate adjustment model. This study compares the predictive accuracy of the learning curve and rate adjustment models. A simulation methodology is used to vary conditions along seven dimensions. Forecast errors are analyzed and compared under the various simulated conditions using ANOVA. Overall results indicate that neither model dominates; each is more accurate under some conditions. Conditions under which each model tends to result in lower forecast errors are identified and discussed. GRA

N91-20623# Human Resources Research Organization, Alexandria, VA.

RESEARCH AND METHODS FOR SIMULATION DESIGN: STATE OF THE ART Final Report, Jan. 1985 - Dec. 1988

PAUL J. STICHA, MICHAEL J. SINGER, H. R. BLACKSTEN, JOHN E. MORRISON, and KENNETH D. CROSS Sep. 1990 187 p

(Contract MDA903-85-C-0169; DA PROJ. 2Q2-63744-A-795)
(AD-A230076; HUMRRO-FR-PRD-88-27; ARI-TR-914) Avail:
NTIS HC/MF A09 CSCL 05/9

The goal is to develop methods to help the training device designer perform the tradeoff analyses required for training device design. These methods should allow the designer to determine the alternatives that meet training requirements at a minimum cost or provide the maximum training effectiveness at a given cost. The methods should apply to the 'concept formulation' phase of the training device development process and should be usable by the engineer responsible for developing the training device concept. The empirical results are reviewed along with analytical methods currently available that can be used to support the training device designer. This review addresses the problem of training system optimization in three ways. First, it describes existing methods that can aid training device design functions. The function and operation of these methods are compared to the model for the 'optimization of simulation based training systems' (OSBATS) developed for this project. Second, it reviews research on several issues related to training device optimization. The issues that are covered in the review include training device fidelity, instructional features, skill acquisition, skill retention, transfer of training, and cost estimation. Third, the review organizes the requirements for future research on these topics and sets priorities for research topics based on their cost and the benefit they could offer to the training device designer. GRA

N91-20624# Army Aeromedical Research Lab., Fort Rucker, AL.

VISUAL SURVEY OF APACHE AVIATORS (VISAA) Final Report

ISAAC BEHAR, ROGER W. WILEY, RICHARD R. LEVINE, CLARENCE E. RASH, and DAVID J. WALSH Sep. 1990 75 p
(Contract USAARL-90-15; DA PROJ. 3M1-62787-A-879)
(AD-A230201) Avail: NTIS HC/MF A04 CSCL 06/4

A three-part study was conducted to assess the visual status of AH-64 pilots. The first part consisted of an anonymous questionnaire returned by 58 Fort Rucker instructor pilots. More than 80 percent of the pilots registered at least one visual complaint (visual discomfort, headache, double vision, blurred vision, disorientation, or afterimages) associated with flying or after flying the Apache aircraft. Many of their comments indicated that symptoms occurred during long flights and/or flying with poor quality or out-of-focus display symbology. In the second part, a comprehensive visual functions test battery was completed on 10 volunteer, highly experienced AH-64 aviators. In the third part, measurements were made on the flight line of the Helmet Mounted Display diopter focus settings made by Apache IPs and students. The diopter settings ranged from 0 to -5.25 with a mean of -2.28. The required positive accommodation by the eye to offset these negative focus settings is very likely a source of visual discomfort and headache during and after long flights. GRA

N91-20625# Florida Univ., Gainesville. Dept. of Psychology.
AUDITORY PATTERN MEMORY Final Report, 1 Oct. 1988 - 30 Sep. 1990

ROBERT D. SORKIN 31 Oct. 1990 53 p
(Contract AF-AFOSR-0021-89; AF PROJ. 2313)
(AD-A229743; AFOSR-90-1164TR) Avail: NTIS HC/MF A04 CSCL 05/8

Three studies of temporal pattern perception were conducted. The listener's task was to determine whether or not two arrhythmic, tonal sequences formed the same temporal pattern. The first study tested the Pattern Correlation model. According to this model, the listener estimates the correlation between the pattern of time intervals marked by the tones in each sequence. Listener performance was characterized by an internal noise that is dependent on the average time between marker tones. The second study tested the effects of temporally compressing or expanding the stimuli. The transformations are common in speech and music; an important feature of temporal pattern perception is the ability to recognize patterns as similar, despite such transformations. An additional internal noise, proportional to the magnitude of the

difference between the pattern transformations, was postulated to describe performance. In the third study, the stimuli were present at different time delays and to separate earphone channels. At very short delays, waveform correlation is the likely comparison mechanism. At longer delays, pattern correlation is the probable mechanism, but this process is ineffective when the temporal patterns overlap. GRA

N91-20626# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, OH.
NEURAL NETWORK BASED HUMAN PERFORMANCE MODELING Final Report, Sep. 1988 - Sep. 1990
 EDWARD L. FIX Aug. 1990 138 p
 (AD-A229822; AAMRL-TR-90-042) Avail: NTIS HC/MF A07 CSDL 06/5

Neural networks provide an alternative method of building models of human performance. They can learn behavior from examples, reducing the need for many identical repetitions and intensive analysis. A properly trained net can be very robust in its response to a novel stimulus. This opens the door to modeling performance in the presence of an interactive stimulus. Neural networks provide the possibility of robust models that can operate interactively in real time, depending on the size and architecture of the net and the application. A neural network architecture derived from recurrent back propagation is presented which learn to mimic human behavior and performance in a sample task. It shows operating characteristics similar to those of human subjects, and even makes the same kinds of mistakes. Possible application are discussed. GRA

N91-20627# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA.
AN ANNOTATED BIBLIOGRAPHY OF THE AIRCREW SELECTION LITERATURE Final Report, Oct. 1988 - May 1990
 DAVID R. HUNTER and EUGENE F. BURKE Sep. 1990 114 p
 (AD-A230484; ARI-RR-1575) Avail: NTIS HC/MF A06 CSDL 05/9

This report summarizes the literature dealing with aircrew selection research conducted through 1989. It includes English language reports available from the open literature and from the United States, United Kingdom, and other armed services. Over 200 studies were identified using computer-assisted and manual searches of the bibliographic data bases and primary and secondary sources. These studies were categorized by the selection measure used. Summaries of the studies were provided. GRA

N91-20628# Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.
ANALYSIS OF VISUAL ILLUSIONS USING GABOR FILTERS M.S. Thesis
 RICHARD A. OBERNDORF Dec. 1990 150 p
 (AD-A230678; AFIT/GE/ENG/90D-47) Avail: NTIS HC/MF A07 CSDL 06/4

This thesis has demonstrated the correctness of using spatial filters in the analysis of various visual illusions; the specific form of filter has been derived from a Gabor equation model of simple cell response on the visual cortex. The Gabor Low Pass Filter (GLPF) applied to these anomalies was derived from proposals made that simple cell response on the visual cortex may be modeled by a set of equations originally proposed by Gabor in the 1940's. Based upon the extension of these equations into two dimensions, a GLPF process was applied to computer-generated black and white illusions (the Kanizsa Triangle, the Spoked Circle and the Ehrenstein Illusion). The results demonstrate that the anomalous contour present in these illusions are explained by an energy boundary surrounding the anomalous area. These differing energies are a direct result of the GLPF process. Much work has been accomplished attempting to understand how and why the human brain perceives visual illusions. From a physiological viewpoint, the process of vision may be divided into two main operations. The first of these deals with the

processing which takes place when light first enters the eye up to the point when this information reaches the visual cortex of the brain. The second area regarding the concept of vision is concerned with how the brain uses this data - the cognition and conceptual formulation which allows recognition of objects. GRA

N91-20629# Chicago Univ., IL. Center for Decision Research.
A THEORY OF DIAGNOSTIC INFERENCE Final Report, 15 Feb. 1987 - 31 Jul. 1990
 ROBIN M. HOGARTH Dec. 1990 30 p
 (Contract N00014-84-C-0018)
 (AD-A230703) Avail: NTIS HC/MF A03 CSDL 05/1

The central theme underlying this work is that complex judgments and choices result from simple psychological processes that interact with highly variable and complex environments. Thus, the research has been aimed at identifying such processes, describing them by parsimonious mathematical models, and testing their implications in experimental tasks. Three lines of research are described. These involve investigations concerning choice under conditions of risk, ambiguity, and ignorance; belief updating; and the effects of exactingness and incentives on the learning of repetitive decision making tasks. Here, exactingness means that the extent of the investigations follows a similar format: statement of issues motivating the research; specification of the model and psychological principles underlying the theoretical approach adopted; and summary of the main experimental results. GRA

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

A91-29110* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

A UNIFIED TELEOPERATED-AUTONOMOUS DUAL-ARM ROBOTIC SYSTEM

SAMAD HAYATI, THOMAS S. LEE, KAM SING TSO, PAUL G. BACKES (JPL, Pasadena, CA), and JOHN LLOYD (McGill University, Montreal, Canada) IEEE Control Systems Magazine (ISSN 0272-1708), vol. 11, Feb. 1991, p. 3-8. refs
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A description is given of complete robot control facility built as part of a NASA telerobotics program to develop a state-of-the-art robot control environment for performing experiments in the repair and assembly of spacelike hardware to gain practical knowledge of such work and to improve the associated technology. The basic architecture of the manipulator control subsystem is presented. The multiarm Robot Control C Library (RCCL), a key software component of the system, is described, along with its implementation on a Sun-4 computer. The system's simulation capability is also described, and the teleoperation and shared control features are explained. I.E.

A91-30178
DEVELOPMENT OF A MODEL FOR CONTROL OF THE NASA CELSS CROP GROWTH RESEARCH CHAMBER

A. L. BLACKWELL and C. C. BLACKWELL (Texas, University, Arlington) IN: 1990 American Control Conference, 9th, San Diego, CA, May 23-25, 1990, Proceedings. Vol. 3. Piscataway, NJ, Institute of Electrical and Electronics Engineers, 1990, p. 2113, 2114. refs
 Copyright

In support of development of bioregenerative life-support systems for space habitats, a chamber for conducting research on the biophysical response of crop plants in controlled environments is being designed by the National Aeronautics and Space Administration. The imprecision of mathematical descriptions

of the behavior of biological systems led to the development of a model which can be used to derive a strategy for control of the chamber environment and which is robust to the system uncertainties. The modeling approach and observations of the characteristics of the model are described. I.E.

A91-30907

A DEMONSTRATION/EVALUATION OF B-1B FLIGHT DIRECTOR COMPUTER CONTROL LAWS - A PILOT PERFORMANCE STUDY

MICHAEL C. REYNOLDS (Midwest Systems Research, Inc., Dayton, OH), BRADLEY D. PURVIS, and W. P. MARSHAK (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 490-494. refs (Contract F33615-89-C-0532)

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A demonstration/evaluation was conducted in November 1989 using operationally qualified B-1B aircraft pilots to determine if any pilot performance differences existed between current and proposed B-1B flight director computer/monitor (FDC/M) control laws during precision approaches using the instrument landing system (ILS). The data (objective and subjective) indicate that the proposed FDC model would be an improvement over the current B-1B FDC model. I.E.

A91-30947

ADVANCED AUDIO DISPLAYS IN AEROSPACE SYSTEMS - TECHNOLOGY REQUIREMENTS AND EXPECTED BENEFITS

DENNIS J. FOLDS (Georgia Institute of Technology, Atlanta) IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 739-743. refs

(Contract MDA903-86-K-0320)

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It is suggested that multiple concurrent audio signals could be used to represent the status of various onboard subsystems and processes, as well as external objects (e.g., threats). Perceptually, these sounds could remain in the background, continuously available to the operator, without causing annoyance or interference with usual voice communications. Research at Georgia Tech is examining the effectiveness of various types of complex, nonspeech sounds for conveying information in the background and its resulting impact on operator performance. The use of steady-state sounds to represent the in-bounds versus out-of-bounds status of one to four concurrent processes was examined. Two conditions were compared: a visual-only condition in which process states were represented solely by visual indicators, and an audiovisual condition in which the visual indicators were supplemented by continuous audio signals. Subjects in the audiovisual condition consistently responded faster and more accurately, committed fewer false alarms, and rated their workload lower than subjects in the visual-only condition. I.E.

A91-30948#

VOICE RECOGNITION AND SYSTEMS ACTIVATION FOR AIRCREW AND WEAPON SYSTEM INTERACTION

DEAN F. GORDON (USAF, Ogden Air Logistics Center, Hill AFB, UT) IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 744-748. refs

For several years, attempts have been made to develop voice systems for weapon system control. One current problem involves voice characteristics changes under different flight conditions, where the original loading is no longer recognizable. It is suggested that a voice system would be a great benefit to single-seat systems where pilot saturation and distraction in complicated and complex cockpits are real problems. It is pointed out that the successful application of artificial intelligence techniques in a commercial voice

recognition/activation system may present potential solutions for military application. To evaluate that potential, a simple test using the F-16 system at Hill AFB, Utah was conducted. Two test pilots recorded various terms selected from the stores management system and flew profiles ranging from 10,000 to 25,000 feet, maneuvering at 7 to 9 Gs. The change in voice quality was readily discernible under those conditions. The next phase was to take a commercial unit and have the two pilots load it with their normal voice, then play the flight recording for that unit. It recognized and reacted to the various terms used. A third and vital step is to take the technology of the commercial unit and design it into a military qualified version, capable of surviving flight environments, with sufficient vocabulary, improved reaction times, and sufficient interface to control several functions for many different applications, all from one standardized/basic unit. I.E.

A91-30949

A COMPARISON OF LOCALIZATION PERFORMANCE WITH TWO AUDITORY CUE SYNTHESIZERS

GERMAN VALENCIA, MARK A. ERICSON (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH), and JEFFREY R. AGNEW (MacAulay-Brown, Inc., Dayton, OH) IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 749-754. refs

(Contract F33615-87-C-0534)

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Auditory localization cue synthesizers capable of presenting three-dimensional sounds over headphones have been constructed. These synthesizers incorporate the transfer algorithms required for optimizing a listener's ability to determine the apparent direction of sound sources. The pilot study reported compared subjects' localization performance with two different prototype synthesizers. The subjects' ability to perceive the direction of target sounds presented in the azimuth plane was measured with each system. Differences in localization performance between the two synthesizers were found in certain areas of the azimuth plane. It is noted that these results are useful in characterizing localization performance using digitally synthesized sound, and eventually will facilitate the application of three-dimensional sound in flight simulators and operational cockpits. I.E.

A91-30950

GESTURE RECOGNITION WITH A DATAGLOVE

DAVID L. QUAM (ARC Professional Services Group, Dayton, OH) IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 755-760.

(Contract F33615-87-C-0534)

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An experiment was conducted to investigate gesture recognition with a human hand manipulating the DataGlove, an electronically instrumented glove which provides information about finger and hand position. A total of 22 gestures in three classes were investigated. The first class contained gestures which only involved finger flexure. The second class contained gestures which required both finger flexure and hand orientation. The third class of gestures required finger motion in addition to flexure and orientation. Only four sensors were necessary to positively identify specific gestures from groups of up to 15 gestures. The results show the specific number of sensors required to positively identify a gesture from a group. This depends on the number of gestures in a group, as well as the class of gestures. I.E.

A91-30951

INDIVIDUALLY TUNED COLOR ENHANCEMENTS FOR IMAGERY INTERPRETATION BY COLOR-IMPAIRED USERS

JAMES E. KESTER (SoTech, Inc., Fairborn, OH) IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York,

Institute of Electrical and Electronics Engineers, Inc., 1990, p. 761, 762.

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Experiments have been performed with software to allow color-impaired users to tune and save their own enhancement scales for image interpretation. An interactive technique that enabled image users to define and save their own scales was developed. Color-impaired subjects were recruited and asked to develop scales to assist them in feature recognition on a set of three images, including both infrared and visual data. Example images that are enhanced by using scales tuned to several different types of color impairment are presented. I.E.

A91-30952

BEYOND KNOBS AND DIALS - TOWARD AN INTENTIONAL MODEL OF MAN-MACHINE INTERACTION

V. V. SECAREA, JR. (Computer Analytics Engineering, Mission Viejo, CA) IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 763-769. refs

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Several critical cognitive dimensions which limit human decision making in reactive environments such as air-to-air combat are investigated. It is noted that future air battles will challenge pilots' abilities to cope with sophisticated, numerically superior adversaries. Aircrews will have to perform critical tasks while meeting the demands of a rapidly evolving and uncertain tactical situation. Human cognitive processes are limited by processing bandwidth, data fidelity, and situation-dependent stresses. Rigidly structured human-machine interfaces may diminish aircrew performance because they do not account for individual differences in cognitive approach. It is argued that automation and new concepts in display design are not the answer. However, results from human factors and cognitive psychology suggest a solution: intelligent intent-driven systems whose response characteristics match knowledge-based schemata compatible with pilots' mental models of their tasks. I.E.

A91-30953

USING ENGINEERING MODELS TO COMPARE PAPER AND HYPERMEDIA-BASED DISPLAYS OF FLIGHT INFORMATION

DIETER J. ZIRKLER (Logicon Technical Services, Inc., Dayton, OH) and KRISTEN MORTON (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 770-774. refs

(Contract F33615-89-C-0532)

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The results of a study conducted to evaluate a proposed design for a hypermedia-based approach chart system are reported. A task analysis was performed of a pilot flying an approach using current paper approach charts. Engineering models were then constructed of the paper and hypermedia approach charts using the GOMS (goal-operators-methods-selection rules) approach. The models were used to calculate the execution time, memory load, and cognitive load of each system. Results indicated that pilots should take approximately the same amount of time to fly an approach using either approach chart system. However, the hypermedia system should place significantly less cognitive workload on the pilot. The method used in this study is suggested as an alternative model of service delivery for human factors specialists. By building task-specific engineering models, human factors specialists can provide a cost-effective tool that allows designers to compare the interfaces of systems at the conceptual design stage. I.E.

A91-30954

THE EFFECT OF KNOWLEDGE-BASED SYSTEM ASSISTANCE ON PILOTING PERFORMANCE, WORKLOAD, AND SATISFACTION

JUDITH H. LIND (U.S. Navy, Naval Weapons Center, China Lake, CA), CHARLES W. HUTCHINS, JR., and DOUGLAS E. NEIL (Performance Evaluation Technology, Inc., Monterey, CA) IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 775-781. refs

Copyright

A prototype software system has been built to evaluate the usefulness of simple artificial intelligence systems in aircraft cockpits. Laboratory evaluations of the system were conducted using a simulated aircraft in a full-mission scenario. Pilot task performance and workload were measured under two conditions: baseline and enhanced with the prototype knowledge-based decision-aiding system; some of the results achieved statistical significance. On the average, the knowledge-based system improved pilot performance in locating surface objects by 36 percent. Performance was improved an average of 42 percent for tasks related to successful response to mission emergencies. Workload was decreased by 13 percent. Overall, 83 percent of the pilots perceived the prototype system to be as effective as, or more effective than, the baseline system. In direct comparisons 81 percent of the pilots preferred the enhanced to the baseline system. I.E.

A91-30955

PRODUCTIVITY APPROACHES FOR MIL-STD-1553

GEORGE D. PIERCE, JR. (Booz, Allen and Hamilton, Inc., Dayton, OH) IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 782-788.

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It is pointed out that the data structures and protocols of MIL-STD-1553 and its related dialects are straightforward. However, implementing 1553 requires extensive software production and usage; therefore, human-computer interface (HCI) needs are great. This situation creates an engineering environment prone to software errors, HCI confusion, incorrectly initialized data, and misinterpreted results. For example, the Data Word formats often tend to be cryptic, intricate, and system peculiar. To reduce the 1553-engineer's workload with respect to exhaustive details, conversions, etc., several approaches to optimizing an HCI are presented. Design critiques, interactive prototypes, and user experiments are discussed. I.E.

A91-30961

QUANTITATIVE METHOD FOR RELATING HELICOPTER CREW TASK PERFORMANCE AND MISSION SUCCESS

WILLIAM B. ASKREN (Universal Energy Systems, Inc., Dayton, OH) and JOSEPH E. BOYETT (Management and Engineering, Inc., Montgomery, AL) IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 825-830. U.S. Army-sponsored research. (Contract F41698-84-D-0052)

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A quantitative method that relates aviator performance at the cockpit task level to system performance at the mission level is described. A series of hierarchical, probabilistic conceptual models were developed that link helicopter crew task performance to mission combat success. The models were fashioned so that predictions can be made from crew task performance, through system function performance, through flight segment performance to mission success. The models allow prediction of the relative contribution of each task, function, and segment to mission success. The models link crew task performance to four mission scores: probability of target kill, probability of surviving an enemy threat, probability of surviving ground hazards, and probability of hitting a navigation window. A proof-of-concept of the models was accomplished using subject matter expert (SME) data that were collected for AH-64 helicopter combat operations. This resulted in

the production of a total of 236 equations that predict from task performance to mission success, and from mission success to task performance. I.E.

A91-30962

DEVELOPMENT OF A GRAVITY INDUCED

LOSS-OF-CONSCIOUSNESS (GLOC) MONITORING SYSTEM

WILLIAM B. ALBERRY (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) and ROBERT E. VAN PATTEN IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 831-837. refs
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The authors present the current status of a loss-of-consciousness detection and recovery system being developed by the US Air Force. It is noted that crucial issue of operational utility of a loss-of-consciousness monitoring system is pilot acceptance. Experience with the auto-save system demonstrated in the AFTI/F-16 has shown that a logic and aircraft-state system could do much to alleviate the loss of pilots and aircraft from the sequelae of gravity-induced loss-of-consciousness. A physiological state variable based system is described, and it is suggested as a natural choice for combination with an auto-save system and would result in enhanced reliability and reduced false alarm incidents, both of which would lead to greater acceptance and reliance on the system. In addition, the development of high-G training curricula for USAF pilots enrolled in lead-in fighter training at Holloman AFB should greatly reduce the risk of GLOC. The development of an assisted positive pressure breathing system, called Combat Edge, will better protect Air Force pilots from long duration, high-G exposures, and will possibly help reduce GLOC statistics. However, neither of these developments, singly or in concert, will totally eradicate the GLOC problem. I.E.

A91-30963#

EVALUATION OF FULL-SORTIE CLOSED-LOOP SIMULATED AERIAL COMBAT MANEUVERING ON THE HUMAN CENTRIFUGE

JOSEPH P. CAMMAROTA (U.S. Navy, Aerial Combat Maneuvering Enhancement Laboratory, Warminster, PA) IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 838-842. refs

The Aerial Combat Environment Simulator (ACES), installed in the human centrifuge at the Naval Air Development Center, was evaluated as an approach to creating an acceleration environment that is similar that encountered in modern tactical aircraft. A pilot in the human centrifuge flew an aircraft simulation to chase a target aircraft through aerial combat maneuvers. The pilot was in complete control of the centrifuge through the simulation, and, if the target tracking was accomplished successfully, the centrifuge produced an acceleration profile that matched the target aircraft. ACES used an enhanced aircraft simulation with the a +Gz performance envelope that exceeded the characteristics observed in aerial combat exercises on instrumented ranges. The centrifuge was equipped with the flight controls necessary to fly the simulation in an air combat scenario. Displays included a high-resolution wide-field-of-view computer graphics system that was used to present a real-world gaming area, an aerial target aircraft, and a high-fidelity head-up display. Seven volunteer subjects were trained to fly the centrifuge and were able to generate +Gz acceleration profiles that replicated the recorded aerial combat exercises. In using this method, the +Gz acceleration stresses imposed on the subjects were very different from those encountered during typical open-loop programs and produced a wide spectrum of physiologic and psychologic +Gz stress related symptoms. I.E.

A91-30964

A SYSTEM TO DETERMINE G-LOC

JOHN R. LACOURSE, KONDAGUNTA SIVAPRASAD (New

Hampshire, University, Durham), and DANA B. ROGERS (Dayton, University, OH) IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 850-855. refs
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The design and capabilities of a noninvasive system to record the superficial temporal artery (STA) pulse pressure of pilots during diving scenarios are described. The piezoelectric pulse pressure monitoring System (P3) records the best waveform from an array of piezoelectric benders in contact with the skin above the STA during 0 Gz acceleration and then continuously monitors it during +Gz acceleration for determination of G-LOC (positive Gz-induced loss of consciousness) conditions. Results indicate that the P3 may be used in a cockpit environment and could be the controller in an aircraft autorecovery system. I.E.

A91-30965

MASSETER EMG AS A MEASURE OF BITE BLOCK USE UNDER VARIOUS GZ LEVELS

T. L. CHELETTE, L. TRIPP, C. LEONARD, V. SKOWRONSKI (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH), C. D. GOODYEAR (Logicon Technical Services, Inc., Dayton, OH) et al. IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 856-858. refs
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Biting down against a mandibular orthopedic repositioning appliance (MORA) that properly aligns the temporomandibular joint (TMJ) requires voluntary contraction of the masseter and temporalis muscles. The effects of this biting maneuver on G tolerance were evaluated. Subjects were fitted with mouthpieces by a dentist qualified in TMJ alignment. Noninvasive BP, ECG (electrocardiogram), and facial EMG (electromyogram) were recorded at 1 G during isometric straining in two sessions of two strains with biting and two strains without biting. Using no anti-G suit, subjects were then exposed to sessions of 0.5 Gz increasing 20 second G plateaus on the W-PAFB dynamic environment simulator (human centrifuge) until loss of peripheral vision. Seven physiological variables were recorded including facial EMG, ear pulse, and transcranial Doppler signals of cerebral artery flow. G tolerance was recorded for three exposures using the MORA and three without it. The resulting EMG and RMS EMG recordings indicated that subjects were not maximally contracting the involved muscles during biting and that muscle fatigue did not occur. Using the MORA resulted in 0.3 Gz mean increase in tolerance compared with not using the MORA, although the difference was not statistically significant at a 0.05 significance level. I.E.

A91-30966#

THE USE OF MULTIPLE PHYSIOLOGICAL MEASURES TO DETERMINE FLIGHT SEGMENT IN F4 PILOTS

GLENN F. WILSON and FRANK FISHER (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 859-861.

Discriminant analysis techniques were used to classify flight segments for ten F-4 pilots from data recorded during air-to-ground training missions. Cardiac and eye blink parameters were used as variables, and 93 percent correct classification was found. It is concluded that this is a quite good result, especially since the combined measures correctly classified all of the segments for six of the 10 pilots, with the lowest percentage of correct classification being 80 percent. This indicates that this method should be considered for use in situations where pilot state and workload must be known. Application of this technique to flight environments of the future is discussed. I.E.

A91-30968

DESIGN OF AN OPTIMUM ANTI-G SUIT CONTROLLER USING AN ADAPTIVE FEEDFORWARD CONTROL SCHEME

KULDIP S. RATTAN and KHALID BARAZANJI (Wright State University, Dayton, OH) IN: NAECON 90; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 21-25, 1990. Vol. 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 869-874. refs
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An effort was made to design an anti-G suit valve controller based on ideal pressure profiles. A computer simulation of the cardiovascular model developed at Wright State University was used to obtain the optimal pressure profiles. The model developed by Jaron and Chu (1984) was used for this simulation. The simulation results show that an optimal duration for the pressure profiles that provides the maximum Gz tolerance exists. The results clearly contradict the belief that the faster the suit filling, the better the design and higher the G-tolerance. An anti-G suit valve controller using an adaptive feedforward control scheme was designed to produce the ideal pressure profiles. I.E.

A91-31450

A SYSTEM TO MEASURE A PILOT'S TEMPORAL PULSE PRESSURE DURING ACCELERATION

JOHN R. LACOURSE, KONDAGUNTA SIVAPRASAD (New Hampshire, University, Durham), and DANA B. ROGERS (Dayton, University, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, April 1991, p. 356-362. refs
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This paper describes the design and capabilities of a noninvasive system to record the superficial temporal artery (STA) pulse pressure during diving scenarios in pilots. The Piezoelectric Pulse Pressure Monitoring System (P3) records the 'best' waveform from an array of piezoelectric benders in contact with the skin above the STA during +1 Gz acceleration and then continuously monitors it during +Gz acceleration for determination of G-LOC conditions. Results indicate that P3 may be used in a cockpit environment and may be the controller in an aircraft autorecovery system. Author

A91-32296* Wisconsin Univ., Madison.

ELECTROTACTILE AND VIBROTACTILE DISPLAYS FOR SENSORY SUBSTITUTION SYSTEMS

KURT A. KACZMAREK, JOHN G. WEBSTER, PAUL BACH-Y-RITA, and WILLIS J. TOMPKINS (Wisconsin, University, Madison) IEEE Transactions on Biomedical Engineering (ISSN 0018-9294), vol. 38, Jan. 1991, p. 1-16. Research supported by Wisconsin Center for Space Automation and Robotics, NASA, and USVA. refs
(Contract NIH-NS-26328)
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Sensory substitution systems provide their users with environmental information through a human sensory channel (eye, ear, or skin) different from that normally used or with the information processed in some useful way. The authors review the methods used to present visual, auditory, and modified tactile information to the skin and discuss present and potential future applications of sensory substitution, including tactile vision substitution (TVS), tactile auditory substitution, and remote tactile sensing or feedback (teletouch). The relevant sensory physiology of the skin, including the mechanisms of normal touch and the mechanisms and sensations associated with electrical stimulation of the skin using surface electrodes (electrotactile, or electrocutaneous, stimulation), is reviewed. The information-processing ability of the tactile sense and its relevance to sensory substitution is briefly summarized. The limitations of current tactile display technologies are discussed. I.E.

N91-19025* Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.

AUTOMATIC SPEECH RECOGNITION IN AIR TRAFFIC CONTROL: A HUMAN FACTORS PERSPECTIVE

JOAKIM KARLSSON /In NASA, Langley Research Center, Joint

University Program for Air Transportation Research, 1989-1990 p 9-13 Dec. 1990

Avail: NTIS HC/MF A09 CSCL 05H

The introduction of Automatic Speech Recognition (ASR) technology into the Air Traffic Control (ATC) system has the potential to improve overall safety and efficiency. However, because ASR technology is inherently a part of the man-machine interface between the user and the system, the human factors issues involved must be addressed. Here, some of the human factors problems are identified and related methods of investigation are presented. Research at M.I.T.'s Flight Transportation Laboratory is being conducted from a human factors perspective, focusing on intelligent parser design, presentation of feedback, error correction strategy design, and optimal choice of input modalities. Author

N91-19582# Nuevas Tecnologias Espaciales S.A., Llíssa d'Amunt (Spain).

DESIGN, IMPLEMENTATION AND EVALUATION OF NEW FULLY AUTOMATED ALGORITHMS FOR THE EXTRACTION OF CARDIAC PARAMETERS FROM 3D, 2D AND M-MODE ECHOCARDIOGRAMS

RENE ALQUEZAR and X. LOBAO /In ESA, Fourth European Symposium on Life Sciences Research in Space p 51-57 Nov. 1990

(Contract ESA-7320/87/NL/PP)

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A new fully automated algorithm that extracts Left Ventricular (LV) epicardial and endocardial borders on echocardiographic short axis view was developed, and a version for determining the LV endocardium on apical views is derived. Two methods for the accurate measurement of LV volume from a set of apical rotated planes are reviewed: cylindrical and disk integration. New fully automated algorithms for mitral and aortic valve M-mode image analysis were developed to extract cardiac times and valve dynamics. All the algorithms were implemented in a simple architecture based on two transputers; requirements for a real time implementation were extrapolated from it. In vitro and in vivo tests were performed to evaluate the volume calculation procedure and the image analysis algorithms respectively. Telescence application of these tools for crew monitoring in long term missions is under study. ESA

N91-19609# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Microgravity User Support Center.

TOOLS FOR THE PREPARATION, PERFORMANCE AND EVALUATION OF LIFE SCIENCES EXPERIMENTS

DITTMAR PADEKEN, MARIANNE SCHUBER, and DIETER SEIBT /In ESA, Fourth European Symposium on Life Sciences Research in Space p 171-174 Nov. 1990

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Life sciences experiments in the field of microgravity research need extensive preparation, performance, and evaluation. Infrastructure for the preparation of experiments covering the disciplines of the human physiology with ESA Anthorack and gravitational biology and biological processing techniques with the German payload Biolabor is given. A survey of the available multipurpose ground infrastructure for Spacelab missions and for the preparation of Columbus user support was built up. The possible application spectrum for life sciences ground facilities is described. The application field of an information system developed for microgravity research (ARIADNE) is shown. ESA

N91-19655# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

TOWARDS BIOREGENERATIVE LIFE SUPPORT SYSTEMS

FRANCOIS BRECHIGNAC /In its Fourth European Symposium on Life Sciences Research in Space p 421-429 Nov. 1990

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The need for bioregenerative technologies in order to support life in the closed space environments is essential, mainly because the servicing/resupply and associated mass launch capabilities are limited for economical reasons. Therefore, rooting from an analogy with the terrestrial ecosystem, the CELSS (Closed Ecological Life Support Systems) technology aims at regenerating food, oxygen and clean water, out of the various waste, in a controlled manner. As the first step towards the development of bioregenerative technologies, the concept of a small scale artificial pilot CELSS is currently being developed in order to support life of small consumers subject to future microgravity experimentation. In view of reducing the complexity, the pilot model is restricted to only two departments. A symbiotic Chorella is used, which can be tuned, by appropriate culture conditions (low pH), to convert most of the photosynthetically fixed carbon dioxide into maltose, a direct source of carbon and energy for a number of potential consumers. The present status of development of this engineering concept is presented along with the various technologies involved. ESA

N91-19656# Dornier System G.m.b.H., Friedrichshafen (Germany, F.R.).

PLANT PRODUCTION AS PART OF A CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEM (CELSS)

KATJA DAVID, ROBERT BACKHAUS (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne, Germany, F.R.), and AKE INGEMAR SKOOG /In ESA, Fourth European Symposium on Life Sciences Research in Space p 431-434 Nov. 1990

Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

To reduce logistics costs of long distance and long duration manned space missions, resupply has to be reduced by recycling and in orbit production of consumables. An essential biochemical reaction in view of the life support requirements is the photosynthesis performed by algae and higher plants. For system closure it is needed in order to close the carbon loop. In contrast to a natural ecosystem, a controlled ecological life support system (CELSS) is designed to meet only human requirements and has to have a stable performance in every subsystem. Therefore, and because of the miniaturization of the system buffer, capacity and tolerable variability are extremely reduced. The critical features of plant production in an artificial ecosystem like a CELSS are presented. ESA

N91-19657# Commissariat a l'Energie Atomique, Cadarache (France). Dept. de Physiologie Vegetale et Ecosystemes.

A GROUND BASED MODULE FOR EXPERIMENTATIONS OF CULTIVATIONS AND RECYCLING IN A CLOSED ENVIRONMENT

MARCEL JEAN ANDRE, D. MASSIMINO, J. MASSIMINO, and M.-C. DUCHEIN /In ESA, Fourth European Symposium on Life Sciences Research in Space p 435-440 Nov. 1990 Sponsored by CNES

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Europe has a strong position in many of the scientific disciplines relevant to controlled ecological life support system (CELSS) program but actual experimentations are very rare and do not correspond to its position in other space research. To stimulate and to organize research, a project of a ground based prototype is proposed. Regarding realizations already running in the USSR and the U.S., this project would have the advantages of developing a European concept of a modular and flexible test bed open to collaborations and of using the know how of our countries in technology growth chambers and chemical engineering. Concepts are proposed to progressively link research in food productivity in artificial conditions and engineering of reclamation and recycling. Results of the pre-pilot stage are presented: long term cultivation in closed chamber, water recycling, computer control of carbon dioxide, oxygen, and water fluxes. ESA

N91-19659# Institute of Crop Science and Plant Breeding, Brunswick (Germany, F.R.).

PHYSIOLOGICAL CRITERIA AND REQUIREMENT OF BIOMASS PRODUCTION UNDER CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEMS

NASIR ELBASSAM, G. MIX, and KATJA DAVID (Dornier System G.m.b.H., Friedrichshafen, Germany, F.R.) /In ESA, Fourth European Symposium on Life Sciences Research in Space p 445-448 Nov. 1990

Copyright Avail: NTIS HC/MF A25; EPD, ESTEC, Noordwijk, Netherlands, HC 80 Dutch guilders

Based on the quantitative caloric and nutritional requirements of man under space conditions and on the physiological limits of plant growth and the chemical constituents of higher plant species, a biological life support system has been established in order to create selection parameters of higher plants for controlled ecological life support systems. The determination of the flow of the main macro-elements of plant development is identified in two major items: (1) consumption (inputs) of carbon dioxide, water, mineral nutrients, illumination, energy; and (2) production (outputs) of oxygen, transpiration, edible biomass and nonedible biomass. The quantity of each of these elements consumed or produced per day is given. The necessary area required for plant production to insure an ecological life support system for one person and one day can be summarized as follows: water 3 to 6, oxygen 6 to 10, and biomass 15 to 20 sq m. ESA

N91-19660# Colorado Univ., Boulder. BioServe Space Technologies Center.

TUNING THE EFFICIENCIES OF PLANT LIGHTING SYSTEMS: FROM PRIMARY ENERGY TO EDIBLE BIOMASS: THE LED AS AN ALTERNATIVE LIGHT SOURCE

ALEXANDER HOEHN and MARVIN W. LUTTGES /In ESA, Fourth European Symposium on Life Sciences Research in Space p 449-454 Nov. 1990

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For space based biological life support systems involving higher plants, an efficient light source capable of fully replacing natural sunlight for plant growth may be required. The conversion processes from some form of primary energy through light energy to edible biomass are described. Possibilities and limitations to improve the conversion efficiencies are outlined. The overall conversion efficiency is influenced by the selected hardware (power source, lamps, required filters, light distribution) and by the biological response to the light environment provided. For each conversion process, a corresponding energy conversion efficiency is defined. The possibilities for improvements are outlined. Only the product of all conversion efficiencies is a proper means of comparing different lighting alternatives. Light emitting diodes (LEDs) as an alternative lighting source for plant growth and photophysiological research, are compared to more commonly used plan lighting sources. Limitations and possible benefits are discussed for intermittent light (flash) as a possibility for energy savings. ESA

N91-19679# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

NEW EXPERIMENTAL APPROACH IN QUALITY FACTOR AND DOSE EQUIVALENT DETERMINATION DURING A LONG TERM MANNED SPACE MISSION

VAN DAT NGUYEN, P. BOUISSET, N. PARMENTIER, M. SIEGRIST, Y. A. AKATOV, V. V. ARCHANGELSKY, S. VOROJTSOV, S. B. KOSLOVA, V. G. MITRIKAS, V. M. PETROV (Institute of Biomedical Problems, Moscow, USSR) et al. /In ESA, Fourth European Symposium on Life Sciences Research in Space p 555-558 Nov. 1990

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Due to high LET (Linear Energy Transfer) particles existing in space environment, the knowledge of the quality factor is one of priority in radiation protection efforts. During the French Soviet space mission Aragatz, the experiment CIRCE (complex beam in

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space counter integrator) had recorded dose equivalent and quality factor values inside the MIR station. Results obtained with a new experimental approach by using an active dose equivalent meter based on microdosimetric techniques and a low pressure tissue equivalent proportional counter are presented. In terms of lineal energy, the CIRCE device works in the 0.3 to 1200 keV micron range in tissue. The average dose equivalent is equal to 0.6 mSv. per day and the mean value of quality factor is equal to 1.9. Through the SAA the dose equivalent rate rapidly increases until 1.20 mSv/h and the corresponding quality factor decreases to 1.4. ESA

N91-19714*# Sterling Federal Systems, Inc., Palo Alto, CA.
ARMY-NASA AIRCREW/AIRCRAFT INTEGRATION PROGRAM (A3I) SOFTWARE DETAILED DESIGN DOCUMENT, PHASE 3
CAROLYN BANDA, ALEX CHIU, GRETCHEN HELMS, TEHMING HSIEH, ANDREW LUI, JERRY MURRAY, and RENUKA SHANKAR Jun. 1990 303 p
(Contract NAS2-11555)
(NASA-CR-177557; A-90197; NAS 1.26:177557) Avail: NTIS HC/MF A14 CSCL 05/8

The capabilities and design approach of the MIDAS (Man-machine Integration Design and Analysis System) computer-aided engineering (CAE) workstation under development by the Army-NASA Aircrew/Aircraft Integration Program is detailed. This workstation uses graphic, symbolic, and numeric prototyping tools and human performance models as part of an integrated design/analysis environment for crewstation human engineering. Developed incrementally, the requirements and design for Phase 3 (Dec. 1987 to Jun. 1989) are described. Software tools/models developed or significantly modified during this phase included: an interactive 3-D graphic cockpit design editor; multiple-perspective graphic views to observe simulation scenarios; symbolic methods to model the mission decomposition, equipment functions, pilot tasking and loading, as well as control the simulation; a 3-D dynamic anthropometric model; an intermachine communications package; and a training assessment component. These components were successfully used during Phase 3 to demonstrate the complex interactions and human engineering findings involved with a proposed cockpit communications design change in a simulated AH-64A Apache helicopter/mission that maps to empirical data from a similar study and AH-1 Cobra flight test. Author

N91-20630*# Space Station Engineering and Integration Contractor, North Olmsted, OH.
AN ASSESSMENT OF THE SPACE STATION FREEDOM PROGRAM'S LEAKAGE CURRENT REQUIREMENT Final Report
MICHAEL NAGY Mar. 1991 16 p Prepared for NASA, Lewis Research Center, Cleveland, OH
(Contract NASW-4300)
(NASA-CR-187077; NAS 1.26:187077; PSL-450-RP91-003A)
Avail: NTIS HC/MF A03 CSCL 06/11

The Space Station Freedom Program requires leakage currents to be limited to less than human perception level, which NASA presently defines as 5 mA for dc. The origin of this value is traced, and the literature for other dc perception threshold standards is surveyed. It is shown that while many varying standards exist, very little experimental data is available to support them.

Author

N91-20631*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
METHOD FOR OPTIMAL CONFIGURATION OF AN ECLSS ON THE SPACE STATION FREEDOM
MARSTON J. GOULD Feb. 1991 23 p
(NASA-TM-104040; NAS 1.15:104040) Avail: NTIS HC/MF A03 CSCL 06/11

The establishment of a permanently manned Space Station represents a substantial challenge in the design of a life support system, specifically in the need to supply a large crew for missions of extended duration. The Space Station will evolve by time phased modular increments delivered and supplied by the Space Shuttle

and other advanced launch systems. With the addition of each subsequent phase or alteration of mission duties, the requirements of the Station may differ from previous phases of development. With the addition of future crews and pressurized volume throughout the lifetime of the Space Station, change-out of individual subsystems may be necessary in order to meet the performance, safety, and reliability levels required from the Environmental Control and Life Support System (ECLSS). The analysis of this system growth demands the capability for advanced, integrated assessment techniques so that the unique mission drivers during each phase and mission scenario may be identified and evaluated. In order to determine the impacts of the interdependency between the ECLSS, the crew, the various user experiments, and the other distributed systems, consideration must be given to all Space Station resources and requirements during the initial and subsequent evolution phase. Therefore, it is necessary for analysis efforts to study the long term effects of established designs. These studies must quantify the optimal degree of loop closure within the capabilities of existing and future technologies including any resulting maintenance and logistics requirements. In addition, the necessity for subsystem retrofit during the lifetime of the Station must be examined. The source of system requirements due to long term exposure to the microgravity environment is illustrated, the criticality of the ECLSS functions is reviewed, and a method is described to develop an optimal design during each configuration based on the cross-consumption of Station resources. A comparison utilizing this procedure is discussed. Author

N91-20632# Vreuls Research Corp., Thousand Oaks, CA.
HUMAN-COMPUTER INTERACTION IN TACTICAL OPERATIONS: DESIGNING FOR EFFECTIVE HUMAN-COMPUTER DIALOGUE Final Report, Jan. 1988 - Jul. 1990
RICHARD W. OBERMAYER and JON J. FALLESEN Sep. 1990 86 p
(Contract MDA903-86-C-0210; DA PROJ. 2Q1-62785-A-790)
(AD-A230069; ARI-RP-90-31) Avail: NTIS HC/MF A05 CSCL 23/2

This report presents guidelines for designing human-computer dialogue for tactical operations. Researchers consolidated sources of information into a form intended for use by designers of tactical computer systems to give them a basis to assess the military impact of dialogue design and take leadership in improving the usability of future systems. This report was developed to support dialogue design for two general situations: (1) the generation of specifications for relatively large-scale systems in which the specific design and development will be performed by another, and (2) the development of relatively small-scale special-purpose systems in which the reader will be the designer and developer, perhaps with the aid of a programmer. The user-computer dialogue is clearly the key to developing systems that fit in with user's goals and tasks. Consequently, this guide will emphasize the essence of the dialogue, clarification of fundamental issues, performance of front-end analyses, selection between alternative dialogue types, and testing for usability. This guide will not address (at least to any major degree) the issues of data display, contents of on-line documentation and help, data transmission, hardware devices, or general human engineering considerations. For those interested in reading further, a reading list and a selected bibliography are provided. Author (GRA)

N91-20633# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA.
A META-ANALYTIC APPROACH FOR RELATING SUBJECTIVE WORKLOAD ASSESSMENTS WITH US ARMY AIRCREW TRAINING MANUAL (ATM) RATINGS OF PILOT PERFORMANCE Final Report, Jun. 1986 - Nov. 1989
JOHN E. STEWART, II and RONALD J. LOFARO Sep. 1990 27 p
(AD-A230127; ARI-TR-913) Avail: NTIS HC/MF A03 CSCL 01/3

In 1985 Lofaro, using a modified Delphi technique, had subject matter experts (SMEs) generate estimated ratings of the subjective

workload imposed by various Aircrew Training Manual (ATM) tasks for several Army helicopters, including the UH-60 Blackhawk. For each task, ratio-scaled estimates of difficulty and time to perform were derived. This research was performed to determine the validity of the UH-60 ATM estimates by correlating them with instructor pilot (IP) ratings of checkride performance from two other unrelated research projects. The other efforts investigated the decay of ATM task-related skills among Reserve and regular Army aviators. A second phase of this project compared the difficulty ratings of ATM tasks associated with UH-60 accidents over FY 1980 to 1988 with those not associated with UH-60 accidents. A negative correlation between the modified Delphi weights assigned to ATM tasks and IP ratings on these tasks was hypothesized; the hypothesis was confirmed. Analysis of the UH-60 accident data confirmed the second hypothesis. GRA

N91-20634# BioTechnology, Inc., Falls Church, VA.
HUMAN FACTORS ISSUES IN AIRCRAFT MAINTENANCE AND INSPECTION: INFORMATION EXCHANGE AND COMMUNICATIONS Final Report
 JAMES F. PARKER, JR. and WILLIAM T. SHEPHERD Nov. 1990 139 p
 (AD-A230270; DOT/FAA/AM-90/14) Avail: NTIS HC/MF A07 CSDL 01/3

The Federal Aviation Administration sponsored a 2-day meeting in December 1989 as part of a continuing program to address issues of human factors and personnel performance in aviation maintenance and inspection. This meeting focused on issues of information exchange and communications. The primary goal was to consider means of ensuring that the exchange of information within the industry responsible for the maintenance of the U.S. air carrier fleet is accurate, efficient, and responsive to the particular needs of this industry. Presentations were given by representatives of commercial aviation interests and covered related efforts from other fields and new technologies having possible application to aviation maintenance. Each presentation was recorded and transcribed for purposes of study and publication. Eight recommendations were made to the Federal Aviation Administration regarding effective communications methodology among the various members of the maintenance industry. GRA

N91-20635# Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.
A LOW-COST PART-TASK FLIGHT TRAINING SYSTEM: AN APPLICATION OF A HEAD MOUNTED DISPLAY M.S. Thesis
 DAVID A. DAHN Dec. 1990 120 p
 (AD-A230353; AFIT/GCE/ENG/90D-01) Avail: NTIS HC/MF A06 CSDL 01/2

To investigate the feasibility of using head-mounted display (HMD) and Computer Image Generators (CIG) in a low cost part-task trainer, we created a prototype system. Our approach was to build a virtual world interface using a HMD to an existing flight simulator application. This allowed a CIG with only one graphics channel to drive the display. To investigate which class of computing platform was suitable for use as the CIG, a cooperative thesis effort was launched to host the simulator on a mini-computer and micro-computer platform. The appropriate CIG could then be determined through demonstration and comparison between the systems. A software emulation library was built to transform the Silicon Graphics graphical reference model and function calls to the PC Reality PHIGS PLUS graphical reference model and function calls. This emulation allowed a nearly seamless interface to support porting the application program from the Silicon Graphics machine to the PC. GRA

N91-20636# Army Natick Labs., MA.
AN ASSESSMENT OF LONG-TERM CHANGES IN ANTHROPOMETRIC DIMENSIONS: SECULAR TRENDS OF US ARMY MALES Final Report, Nov. 1988 - Jun. 1990
 THOMAS M. GREINER and CLAIRE C. GORDON Dec. 1990 72 p
 (AD-A230416; NATICK/TR-91/006) Avail: NTIS HC/MF A04 CSDL 05/5

This report describes long-term changes in the body dimensions within the Army population for 22 body dimensions in four racial/cultural groups: Whites, Blacks, Hispanics and Asian/Pacific Islanders. Individuals were grouped by birth year into 12 five-year cohorts, which span the years 1911 to 1970. Rates of change were calculated by regressing age-adjusted dimensions against cohort. Analyses of these relationships showed that almost all dimensions sustained statistically significant linear trends, the few exceptions being found within the Asian/Pacific Islanders group. Furthermore, except for the Asian/Pacific Islanders, the greatest relative rates of change were found in dimensions related to soft tissue development rather than skeletal dimensions. This pattern is consistent with the most recent American cultural emphasis on health and physical fitness. The markedly different patterns seen in Asian/Pacific Islanders were best explained by immigration: they have experienced a linear increase in the proportion of foreign born members. GRA

N91-20637# Naval Health Research Center, San Diego, CA.
BODY COMPOSITION IN MILITARY SERVICES: STANDARDS AND METHODS Final Report
 J. A. HODGDON 28 Sep. 1990 19 p
 (AD-A230435; NHRC-90-21) Avail: NTIS HC/MF A03 CSDL 05/9

This paper deals with two topics: The development of body composition standards in the U.S. Navy; and the methods of body composition assessment in use by the military Services today. In 1981, the Services were directed to develop body composition and fat standards consistent with the mission of the Services. Three concerns were outlined which dictated the establishment of weight control policy: (1) body composition was an integral part of physical fitness; (2) body composition is a determinant of appropriate military appearance; and (3) body composition is a determinant of general health and well-being of military personnel. Each of these three concerns was explored as a basis for setting standards for body composition in the Navy. Our investigations of relationships between body composition variables and performance of materials handling tasks suggest that percent body fat is not strongly related to such performance. Estimated fat-free mass, on the other hand, is highly correlated with strength and the ability to lift objects. GRA

N91-20638# Naval Postgraduate School, Monterey, CA.
LATENT FACTOR MODELS AND ANALYSES FOR OPERATOR RESPONSE TIMES
 DONALD P. GAVER and I. G. OMUIRCHEARTAIGH Sep. 1990 67 p
 (AD-A229675; NPS55-90-20) Avail: NTIS HC/MF A04 CSDL 12/3

Two models are presented for the response times of different operators to different tasks where response is initiated by one or more cues provided by the system. One model for the log-response times is a mixed or latent factor model with unequal case fixed effects and variances. The other model for the log-response times is a non-Gaussian log-extreme-value model. Procedures for estimating the parameters by maximum likelihood are presented. The models are used to analyze response time data from simulator experiments involving nuclear power plant operators performing certain safety-related tasks. The findings of the models are critiqued and applications to risk analysis are sketched. GRA

N91-20639# East Tennessee State Univ., Johnson City. Dept. of Physiology.
ENHANCING THE TOLERANCE TO GZ(+) ACCELERATION BY OPTIMIZING THE USE OF ISOMETRIC CONTRACTIONS IN COMBINATION WITH STRAINING MANEUVERS Final Report, Oct. 1986 - Sep. 1987
 CAROLE A. WILLIAMS, J. MARTIN, J. MOFFATT, J. E. DOUGLAS, and A. R. LIND Aug. 1990 48 p
 (Contract F33615-85-C-0530)
 (AD-A230454; AAMRL-TR-90-044) Avail: NTIS HC/MF A03 CSDL 06/5

Experiments were performed on 9 male subjects who exerted

L-1 straining maneuvers in a pilot chair apparatus with a seatback at 30 and a spine-to-thigh angle of 110. The L-1 maneuvers were performed with or without simultaneous application of isometric contractions. Contractions were exerted at high levels of force in either a sustained fashion or in an intermittent fashion, in 15 sec periods, until fatigue occurred. Isometric contractions were exerted by either the forearm flexors (handgrip), quadriceps, or jaw muscles at tensions of 70 percent MVC (handgrip, quadriceps) or 100 percent MVC (jaw). During the experiments, changes in arterial pressure, heart rate and electromyographic activity, from the intercostals and the contracting muscle group, were recorded. During the L-1 maneuver alone, mean blood pressure (MBP) increased to 205 mmHg initially at the onset of the maneuver, but then fell by 50 mmHg, to 155 mmHg during the first 5 seconds of the procedure. The MBP recovered to 170 mmHg and remained at this level during the last 5 sec of the procedure. When isometric contractions were simultaneously applied, initial MBP were essentially the same as with the L-1 maneuver alone, but there was significantly higher MBP maintained throughout the remainder of the L-1 procedure with the isometric contractions, such that MBP averaged almost 30 mmHg higher during the last 5 sec of the procedure. GRA

N91-20640# Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.

REAL-TIME FLIGHT SIMULATION AND THE HEAD-MOUNTED DISPLAY: AN INEXPENSIVE APPROACH TO MILITARY PILOT TRAINING M.S. Thesis

PHILIP A. PLATT Dec. 1990 81 p
(AD-A230469; AFIT/GCS/ENG/90D-11) Avail: NTIS HC/MF A05 CSCL 12/5

The integration of the low-cost head-mounted display (HMD), an inexpensive graphics workstation-based flight simulator, and a communications network was investigated to determine if the prototype of an inexpensive multi-aircraft Virtual Flight Simulator could be built. Previous research efforts have coupled HMD technology and flight simulation; however, the cost of these systems has been high. This thesis effort emphasized the use of joystick devices to emulate pilot control, the implementation of a fully enclosed virtual flight simulator, and the utilization of low-cost television technology to produce a prototype. The virtual flight simulator also contained a basic set of instruments to help the pilot control the aircraft. The virtual world provided a full color 360 degree viewing capability which allowed the pilot to look around his aircraft and world. Although the display update rates of the final system were less than ideal, the results showed that the concept of virtual flight simulators has potential for improving the Air Force's overall pilot training capability. GRA

N91-20683*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

INTELLIGENT MONITORING AND DIAGNOSIS SYSTEMS FOR THE SPACE STATION FREEDOM ECLSS

BRANDON S. DEWBERRY and JAMES R. CARNES (Boeing Co., Huntsville, AL.) In NASA, Lyndon B. Johnson Space Center, Fourth Annual Workshop on Space Operations Applications and Research (SOAR 90) p 338-343 Jan. 1991
Avail: NTIS HC/MF A21 CSCL 05/8

Specific activities in NASA's environmental control and life support system (ECLSS) advanced automation project that is designed to minimize the crew and ground manpower needed for operations are discussed. Various analyses and the development of intelligent software for the initial and evolutionary Space Station Freedom (SSF) ECLSS are described. The following are also discussed: (1) intelligent monitoring and diagnostics applications under development for the ECLSS domain; (2) integration into the MSFC ECLSS hardware testbed; and (3) an evolutionary path from the baseline ECLSS automation to the more advanced ECLSS automation processes. Author

N91-20703*# Air Force Systems Command, Norton AFB, CA. Space Systems Div.

A HUMAN FACTORS APPROACH TO RANGE SCHEDULING FOR SATELLITE CONTROL

CAMERON H. G. WRIGHT and DONALD J. AITKEN In NASA, Lyndon B. Johnson Space Center, Fourth Annual Workshop on Space Operations Applications and Research (SOAR 90) p 484-489 Jan. 1991

(Contract F04701-86-C-0007)

Avail: NTIS HC/MF A14 CSCL 05/8

Range scheduling for satellite control presents a classical problem: supervisory control of a large-scale dynamic system, with unwieldy amounts of interrelated data used as inputs to the decision process. Increased automation of the task, with the appropriate human-computer interface, is highly desirable. The development and user evaluation of a semi-automated network range scheduling system is described. The system incorporates a synergistic human-computer interface consisting of a large screen color display, voice input/output, a 'sonic pen' pointing device, a touchscreen color CRT, and a standard keyboard. From a human factors standpoint, this development represents the first major improvement in almost 30 years to the satellite control network scheduling task. Author

N91-20707*# Oregon State Univ., Corvallis. Dept. of Industrial and Manufacturing Engineering.

COCKPIT TASK MANAGEMENT: A PRELIMINARY, NORMATIVE THEORY

KEN FUNK In NASA, Lyndon B. Johnson Space Center, Fourth Annual Workshop on Space Operations Applications and Research (SOAR 90) p 508-520 Jan. 1991

Avail: NTIS HC/MF A14 CSCL 05/8

Cockpit task management (CTM) involves the initiation, monitoring, prioritizing, and allocation of resources to concurrent tasks as well as termination of multiple concurrent tasks. As aircrews have more tasks to attend to due to reduced crew sizes and the increased complexity of aircraft and the air transportation system, CTM will become a more critical factor in aviation safety. It is clear that many aviation accidents and incidents can be satisfactorily explained in terms of CTM errors, and it is likely that more accidents induced by poor CTM practice will occur in the future unless the issue is properly addressed. The first step in understanding and facilitating CTM behavior was the development of a preliminary, normative theory of CTM which identifies several important CTM functions. From this theory, some requirements for pilot-vehicle interfaces were developed which are believed to facilitate CTM. A prototype PVI was developed which improves CTM performance and currently, a research program is under way that is aimed at developing a better understanding of CTM and facilitating CTM performance through better equipment and procedures. Author

N91-20711*# Ohio State Univ., Columbus. Cognitive Systems Engineering Lab.

COGNITIVE CONSEQUENCES OF CLUMSY AUTOMATION ON HIGH WORKLOAD, HIGH CONSEQUENCE HUMAN PERFORMANCE

RICHARD I. COOK, DAVID D. WOODS, ELIZABETH MCCOLLIGAN, and MICHAEL B. HOWIE In NASA, Lyndon B. Johnson Space Center, Fourth Annual Workshop on Space Operations Applications and Research (SOAR 90) p 543-546 Jan. 1991

(Contract NCC2-592)

Avail: NTIS HC/MF A14 CSCL 05/8

The growth of computational power has fueled attempts to automate more of the human role in complex problem solving domains, especially those where system faults have high consequences and where periods of high workload may saturate the performance capacity of human operators. Examples of these domains include flightdecks, space stations, air traffic control, nuclear power operation, ground satellite control rooms, and surgical operating rooms. Automation efforts may have unanticipated effects on human performance, particularly if they

increase the workload at peak workload times or change the practitioners' strategies for coping with workload. Smooth and effective changes in automation requires detailed understanding of the cognitive tasks confronting the user: it has been called user centered automation. The introduction of a new computerized technology in a group of hospital operating rooms used for heart surgery was observed. The study revealed how automation, especially 'clumsy automation', effects practitioner work patterns and suggest that clumsy automation constrains users in specific and significant ways. Users tailor both the new system and their tasks in order to accommodate the needs of process and production. The study of this tailoring may prove a powerful tool for exposing previously hidden patterns of user data processing, integration, and decision making which may, in turn, be useful in the design of more effective human-machine systems. Author

N91-20719* Lockheed Engineering and Sciences Co., Houston, TX.

SPACECRAFT CREW PROCEDURES FROM PAPER TO COMPUTERS

MICHAEL ONEAL and MEERA MANAHAN In NASA, Lyndon B. Johnson Space Center, Fourth Annual Workshop on Space Operations Applications and Research (SOAR 90) p 595-600 Jan. 1991

(Contract NAS9-17900)

Avail: NTIS HC/MF A14 CSDL 05/8

Described here is a research project that uses human factors and computer systems knowledge to explore and help guide the design and creation of an effective Human-Computer Interface (HCI) for spacecraft crew procedures. By having a computer system behind the user interface, it is possible to have increased procedure automation, related system monitoring, and personalized annotation and help facilities. The research project includes the development of computer-based procedure system HCI prototypes and a testbed for experiments that measure the effectiveness of HCI alternatives in order to make design recommendations. The testbed will include a system for procedure authoring, editing, training, and execution. Progress on developing HCI prototypes for a middeck experiment performed on Space Shuttle Mission STS-34 and for upcoming medical experiments are discussed. The status of the experimental testbed is also discussed. Author

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SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A91-28636* Nijmegen Univ. (Netherlands).

OLIGOMERIZATIONS OF DEOXYADENOSINE BIS-PHOSPHATES AND OF THEIR 3-PRIME-5-PRIME, 3-PRIME-3-PRIME, AND 5-PRIME-5-PRIME DIMERS - EFFECTS OF A PYROPHOSPHATE-LINKED, POLY(T) ANALOG

J. VISSCHER, C. G. BAKKER, and ALAN W. SCHWARTZ (Nijmegen, Katholieke Universiteit, Netherlands) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 5, 1990, p. 369-375. refs

(Contract NGR-05-067-001)

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The effect of a 3-prime-5-prime pyrophosphate-linked oligomer of pTp on oligomerizations of pdAp and of its 3-prime-5-prime, 3-prime-3-prime, and 5-prime-5-prime dimers was investigated, using HPLC to separate the reaction mixtures; peak detection was by absorbance monitoring at 254 nm. It was expected that the dimers would form stable complexes with the template, with the degree of stability depending upon the internal linkage of each dimer. It was found that, although the isomers differ substantially in their oligomerization behavior in the absence of template, the analog-template catalyzes the oligomerization to about the same extent in all three cases. I.S.

A91-28637

THE GAMMA-IRRADIATION OF AQUEOUS ACETIC ACID-CLAY SUSPENSIONS

ALICIA NEGRON-MENDOZA and RAFAEL NAVARRO-GONZALEZ (Universidad Nacional Autonoma de Mexico, Coyoacan, Mexico) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 5, 1990, p. 377-387. refs

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Gamma-radiolysis of 0.8 mol/cu dm aqueous, oxygen-free acetic acid solutions was investigated in the presence of Na-montmorillonite (1-3 g/10 cu cm). The systems were irradiated at their natural pH (3.5), and 25 C in a dose range from 0.01 to 500 kGy. H₂, CH₄, CO, CO₂, and a variety of polycarboxylic acids were formed in all systems. The major features of the radiolysis in the presence of clays were: (1) more solute molecules were decomposed; (2) carbon dioxide was produced in higher yield; (3) the yield of methane was unaffected; and (4) 44 percent less polycarboxylic acids were formed. Three possible mechanisms that could account for the observed changes are suggested. The results are important in understanding heterogeneous processes in radiation catalysis and might be significant to prebiotic chemistry. Author

A91-28638

PREBIOTIC SYNTHESIS OF OROTIC ACID PARALLEL TO THE BIOSYNTHETIC PATHWAY

Y. YAMAGATA, K. SASAKI, O. TAKAOKA, S. SANO, K. INOMATA (Kanazawa University, Japan) et al. Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 5, 1990, p. 389-399. refs

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By heating an aqueous solution of aspartic acid and urea, carbamylaspartic acid is first formed and then the molecule is cyclized to dihydroorotic acid (DHO) with loss of water. Irradiation of an aqueous solution of DHO with a tungsten lamp yields orotic acid by photo-dehydrogenation of the molecule. This pathway of orotic acid formation is quite similar to that of biosynthesis of the molecule. Author

A91-28639

COPPER-CATALYZED AMINO ACID CONDENSATION IN WATER - A SIMPLE POSSIBLE WAY OF PREBIOTIC PEPTIDE FORMATION

BERND M. RODE and MICHAEL G. SCHWENDINGER (Innsbruck, Universitaet, Austria) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 5, 1990, p. 401-410. refs

(Contract FFWF PROJECT P-7393-CHE)

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The recently reported condensation reaction of glycine to di- and triglycine in aqueous solution in the presence of higher concentrations of sodium chloride and copper ions has been investigated systematically and quantitatively using HPLC analytical methods. The effects of 'environmental' factors (temperature, concentration, and atmosphere) are discussed. Numerous other metal ions have been investigated with respect to similar catalytic effects, and molybdenum results as the only one inducing peptide condensation, although to a much lesser extent. Experiments based on evaporation of water and redissolution lead to peptide condensation up to (gly)₆ in concentrated solutions and produce peptides even starting from initially low concentrations. Author

A91-28640

SELECTIVE CHIRALITY - A CLOSER EXAMINATION

WILLIAM A. BONNER (Stanford University, CA) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 20, no. 5, 1990, p. 411-417. refs

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This paper presents criticism to the suggestion of Root-Bernstein (1982) that the homochirality of amino acids and sugars was caused by something other than asymmetric forces or aggregative chirality, proposing the existence of 'selector molecules' that promote selective chirality. The possibility of potential existence of the selector molecules proposed by

Root-Bernstein is investigated, and it is shown that the arguments presented by Root-Bernstein are based on invalid chemical and stereochemical concepts. I.S.

A91-30737 Observatoire de Paris-Meudon (France).

UV SPECTROSCOPY OF TITAN'S ATMOSPHERE, PLANETARY ORGANIC CHEMISTRY AND PREBIOLOGICAL SYNTHESIS. II - INTERPRETATION OF NEW IUE OBSERVATIONS IN THE 220-335 NM RANGE

REGIS COURTIN (Paris, Observatoire, Meudon, France), RICHARD WAGENER (New York, State University, Stony Brook), CHRISTOPHER P. MCKAY (NASA, Ames Research Center, Moffett Field, CA), JOHN CALDWELL (York University, Canada), KARL-HEINRICH FRICKE (Bonn, Universitaet, Federal Republic of Germany) et al. Icarus (ISSN 0019-1035), vol. 90, March 1991, p. 43-56. Research supported by CNRS and NSERC. refs (Contract NAS5-29301)

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The theoretical model developed by McKay et al. (1989) to characterize the size distribution, thermal structure, and chemical composition of the stratospheric haze of Titan is applied to new 220-335-nm albedo measurements obtained with the long-wavelength prime camera of the IUE during August 1987. Data and model predictions are presented in extensive graphs and discussed in detail. It is shown that a simple model with particles of one size at a given altitude does not accurately reproduce the observed features in all spectral regions, but that good general agreement is obtained using a model with a uniformly mixed layer at 150-600 km and a bimodal distribution of small 'polymer' haze particles (radius less than 20 nm) and larger haze particles (radius 100-500 nm). The number densities implied by this model require, however, a mechanism such as electrostatic charging or reaction kinetics to inhibit coagulation of the smaller particles. D.G.

A91-31206* Arizona State Univ., Tempe.

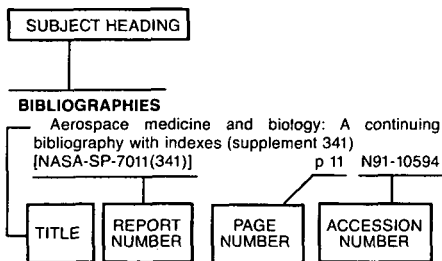
ISOTOPIC ANALYSES OF AMINO ACIDS FROM THE MURCHISON METEORITE

S. PIZZARELLO, J. R. CRONIN (Arizona State University, Tempe), R. V. KRISHNAMURTHY, and S. EPSTEIN (California Institute of Technology, Pasadena) Geochimica et Cosmochimica Acta (ISSN 0016-7037), vol. 55, March 1991, p. 905-910. refs (Contract NSG-7255; NAGW-1899)

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An account is given of the results of H-2, C-13 isotopic analyses of the Murchison meteorite incorporating an ultrafiltration step to exclude the possibility of fine particulate contaminants. The meteorite's amino acids were chromatographically separated in order to preclude isotopic enrichment by basic compounds other than the amino acids. The results indicate that the Murchison amino acids are isotopically highly unusual; delta-C-13 is elevated by about 40 percent, and delta-D by fully 2500 percent. This high D content of the meteorite's alpha-amino acids may be due to the synthesis of their molecular precursors by low-temperature ion-molecule reactions in an interstellar cloud. O.C.

Typical Subject Index Listing



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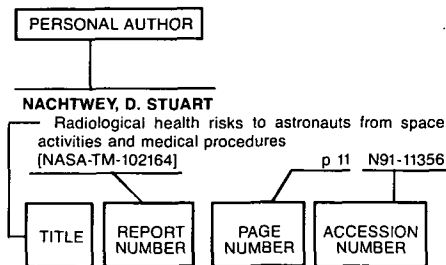
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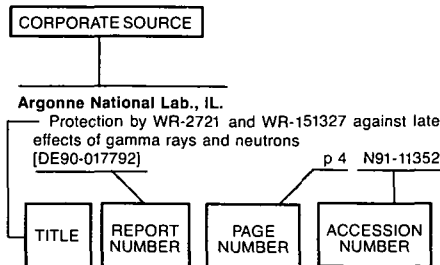
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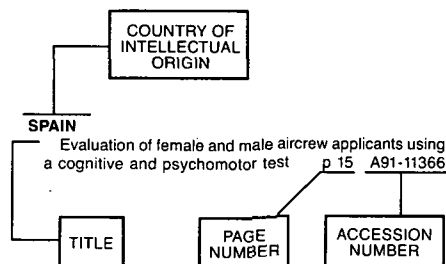
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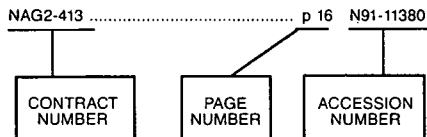
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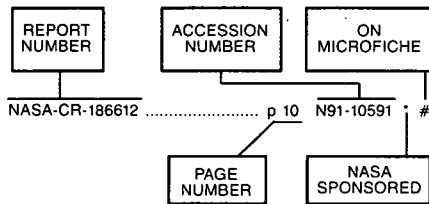


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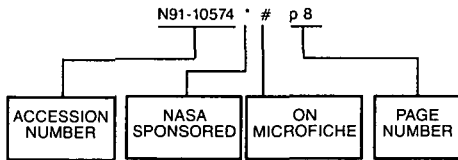
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Lexington, KY 40506-0039
(606) 257-3139 FAX: (606) 257-1563;
257-8379

LOUISIANA

LOUISIANA STATE UNIV.

Middleton Library
Govt. Documents Dept.
Baton Rouge, LA 70803
(504) 388-2570 FAX: (504) 388-6992

LOUISIANA TECHNICAL UNIV.

Prescott Memorial Library
Govt. Documents Dept.
305 Wisteria Street
Ruston, LA 71270-9985
(318) 257-4962 FAX: (318) 257-2447

MAINE

TRI-STATE DOCUMENTS DEPOSITORY

Raymond H. Fogler Library
Govt. Documents & Microforms Dept.
Univ. of Maine
Orono, ME 04469
(207) 581-1680

MARYLAND

UNIV. OF MARYLAND

Hornbake Library
Govt. Documents/Maps Unit
College Park, MD 20742
(301) 454-3034 FAX: (301) 454-4985

MASSACHUSETTS

BOSTON PUBLIC LIBRARY

Govt. Documents Dept.
666 Boylston Street
Boston, MA 02117
(617) 536-5400 ext. 226
FAX: (617) 267-8273; 267-8248

MICHIGAN

DETROIT PUBLIC LIBRARY

5201 Woodward Avenue
Detroit, MI 48202-4093
(313) 833-1440; 833-1409
FAX: (313) 833-5039

LIBRARY OF MICHIGAN

Govt. Documents Unit
P.O. Box 30007
Lansing, MI 48909
(517) 373-0640 FAX: (517) 373-3381

MINNESOTA

UNIV. OF MINNESOTA

Wilson Library
Govt. Publications Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 624-5073 FAX: (612) 626-9353

MISSISSIPPI

UNIV. OF MISSISSIPPI

J.D. Williams Library
Federal Documents Dept.
106 Old Gym Bldg.
University, MS 38677
(601) 232-5857 FAX: (601) 232-5453

MISSOURI

UNIV. OF MISSOURI - COLUMBIA

Ellis Library
Govt. Documents
Columbia, MO 65201
(314) 882-6733 FAX: (314) 882-8044

MONTANA

UNIV. OF MONTANA

Maureen & Mike Mansfield Library
Documents Div.
Missoula, MT 59812-1195
(406) 243-6700 FAX: (406) 243-2060

NEBRASKA

UNIV. OF NEBRASKA - LINCOLN

D.L. Love Memorial Library
Documents Dept.
Lincoln, NE 68588
(402) 472-2562

NEVADA

UNIV. OF NEVADA

Reno Library
Govt. Publications Dept.
Reno, NV 89557
(702) 784-6579 FAX: (702) 784-1751

NEW JERSEY

NEWARK PUBLIC LIBRARY

U.S. Documents Div.
5 Washington Street -
P.O. Box 630
Newark, NJ 07101-0630
(201) 733-7812 FAX: (201) 733-5648

NEW MEXICO

UNIV. OF NEW MEXICO

General Library
Govt. Publications Dept.
Albuquerque, NM 87131-1466
(505) 277-5441 FAX: (505) 277-6019

NEW MEXICO STATE LIBRARY

325 Don Gaspar Avenue
Santa Fe, NM 87503
(505) 827-3826 FAX: (505) 827-3820

NEW YORK

NEW YORK STATE LIBRARY

Documents/Gift & Exchange Section
Federal Depository Program
Cultural Education Center
Albany, NY 12230
(518) 474-5563 FAX: (518) 474-5786

NORTH CAROLINA

UNIV. OF NORTH CAROLINA -

CHAPEL HILL

CB#3912, Davis Library
BA/SS Dept.—Documents
Chapel Hill, NC 27599
(919) 962-1151 FAX: (919) 962-0484

NORTH DAKOTA

NORTH DAKOTA STATE UNIV. LIBRARY

Documents Office
Fargo, ND 58105
(701) 237-8886 FAX: (701) 237-7138
In cooperation with Univ. of North
Dakota, Chester Fritz Library
Grand Forks

OHIO

STATE LIBRARY OF OHIO

Documents Dept.
65 South Front Street
Columbus, OH 43266
(614) 644-7051 FAX: (614) 752-9178

OKLAHOMA

OKLAHOMA DEPT. OF LIBRARIES

U.S. Govt. Information Div.
200 NE 18th Street
Oklahoma City, OK 73105-3298
(405) 521-2502, ext. 252, 253
FAX: (405) 525-7804

OKLAHOMA STATE UNIV.

Edmon Low Library
Documents Dept.
Stillwater, OK 74078
(405) 744-6546 FAX: (405) 744-5183

OREGON

PORTLAND STATE UNIV.

Millar Library
934 SW Harrison - P.O. Box 1151
Portland, OR 97207
(503) 725-3673 FAX: (503) 725-4527

PENNSYLVANIA

STATE LIBRARY OF PENN.

Govt. Publications Section
Walnut St. & Commonwealth Ave. -
P.O. Box 1601
Harrisburg, PA 17105
(717) 787-3752

SOUTH CAROLINA

CLEMSON UNIV.

Cooper Library
Public Documents Unit
Clemson, SC 29634-3001
(803) 656-5174 FAX: (803) 656-3025
In cooperation with Univ. of South
Carolina, Thomas Cooper Library,
Columbia

TENNESSEE

MEMPHIS STATE UNIV. LIBRARIES

Govt. Documents
Memphis, TN 38152
(901) 678-2586 FAX: (901) 678-2511

TEXAS

TEXAS STATE LIBRARY

United States Documents
P.O. Box 12927 - 1201 Brazos
Austin, TX 78711
(512) 463-5455 FAX: (512) 463-5436

TEXAS TECH. UNIV. LIBRARY

Documents Dept.
Lubbock, TX 79409
(806) 742-2268 FAX: (806) 742-1920

UTAH

UTAH STATE UNIV.

Merrill Library & Learning Resources
Center, UMC-3000
Documents Dept.
Logan, UT 84322-3000
(801) 750-2684 FAX: (801) 750-2677

VIRGINIA

UNIV. OF VIRGINIA

Alderman Library
Govt. Documents
Charlottesville, VA 22903-2498
(804) 924-3133 FAX: (804) 924-4337

WASHINGTON

WASHINGTON STATE LIBRARY

Document Section
MS AJ-11
Olympia, WA 98504-0111
(206) 753-4027 FAX: (206) 753-3546

WEST VIRGINIA

WEST VIRGINIA UNIV. LIBRARY

Govt. Documents Section
P.O. Box 6069
Morgantown, WV 26506
(304) 293-3640

WISCONSIN

ST. HIST. SOC. OF WISCONSIN LIBRARY

Govt. Publications Section
816 State Street
Madison, WI 53706
(608) 262-2781 FAX: (608) 262-4711
In cooperation with Univ. of Wisconsin-
Madison, Memorial Library

MILWAUKEE PUBLIC LIBRARY

Documents Div.
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 278-2167 FAX: (414) 278-2137

WYOMING

WYOMING STATE LIBRARY

Supreme Court & Library Bldg.
Govt. Publications
Cheyenne, WY 82002
(307) 777-5920 FAX: (307) 777-6289

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